R.S.

MBL/WHOI
0 0301 0016995 9

THE

RAY SOCIETY

INSTITUTED MDCCCXLIV

This volume is issued to the Subscribers to the RAY SOCIETY *for the Year* 1919

LONDON

MCMXX

A MONOGRAPH

OF THE

BRITISH ORTHOPTERA

BY

WILLIAM JOHN LUCAS, B.A.,

FELLOW OF THE ENTOMOLOGICAL SOCIETY OF LONDON.

Author of 'A Monograph of the British Dragonflies,' 'British Butterflies,' 'British Hawk-moths,' etc.

LONDON

PRINTED FOR THE RAY SOCIETY

1920

PRINTED BY ADLARD AND SON AND WEST NEWMAN, LTD.
LONDON AND DORKING.

PREFACE.

In presenting to the entomological public a "Monograph of the British Orthoptera" a few words are necessary with regard to the scope and object of the work.

Though the treatment adopted may seem to reduce the list of our species to a smaller total than that usually given, it has been employed with the object of confining attention to those species only that can with reason be looked upon as dwellers in our midst, the criterion of British nationality being whether breeding takes place in these islands, or not. If it does, the insect concerned has been given a definite status on our list, even though it may be able to exist with us only under artificial conditions of warmth and shelter. By this arrangement a large number of casual visitors (conveyed here nearly always by accidental transportation) are excluded, as having no claim whatever to be called British insects.

It can scarcely be expected that any great addition will be made to the number of British species, yet one or two new ones may fairly be looked for, when those naturalists who investigate our orthopterous fauna have become more numerous. On the other hand, it is to be feared that one of our earwigs is destined to almost certain extinction in the near future.

Under the heading "synonymy" will be found

references to a few authors, either because their writings are of interest to English readers, or as being the authorities for important synonyms. Those readers who require a more complete synonymy are referred to W. F. Kirby's 'Synonymic List of the Orthoptera,' a reference to this important work being given in the treatment of each insect.

At the present day there is no necessity to make an apology for occupying space with original descriptions, their value being generally acknowledged.

In most cases the early stages of our Orthoptera are but little known, nor is it an easy matter to investigate them. Here anyone taking up the study of the Order will find great scope for his activities.

For some naturalists the habits and distribution of the various species have a special interest. These branches of the subject, therefore, have been treated as fully as circumstances would allow. Here also is abundant opportunity for research. There are in fact large tracts of the British Isles whose orthopterous fauna is practically unknown, and, until students of the Order become more numerous, apparently must remain so.

It is the very pleasing duty of the author to record his obligation to a large number of correspondents, who have provided notes and sent lists of localities or insects for inspection to assist him in the compilation of the paragraphs on British distribution. The list includes: W. J. Ashdown, E. A. Atmore, E. C. Bedwell, H. W. Bell-Marley, G. C. Bignell, L. Blathwayt, E. N. Bloomfield, W. Bracken, C. A. Briggs, S. E. Brock, F. Balfour-Browne, M. Burr, H. Campion, G. C. Champion, T. A. Chapman, A. Cant, R. T. Cassal, A. J. Chitty, T. A. Coward, C. W. Dale, J. G. Dalgliesh,

W. Daws, F. H. Day, H. M. Edelsten, F. W. Edwards, J. Edwards, W. Evans, G. E. Frisby, H. Guermonprez, J. N. Halbert, A. H. Hamm, B. S. Harwood, W. Hewett, W. Holland, W. J. Jones, F. C. R. Jourdain, S. W. Kemp, C. G. Lamb, G. T. Lyle, B. McGowan, H. Main, H. Moore, C. Morley, K. J. Morton, J. Nicholson, G. T. Porritt, R. B. and Miss Nellie Robertson, A. O. Rowden, E. Saunders, D. Sharp, Eland Shaw, A. Sich, E. J. B. Sopp, R. South, A. M. Stewart, E. A. C. Stowell, J. R. le B. Tomlin, H. R. Wakefield, J. J. Walker, W. West, O. Whittaker, J. W. Yerbury, and many others who have kindly helped in a similar way.

Most of the Irish localities are due to specimens in the collection at Trinity College, Dublin, the list of which was communicated by S. W. Kemp: hence the reference—*fide Kemp*.

All the plates and figures have been reproduced from the author's drawings or photographs, with the exception of Plate IV, fig. 3, and the whole of Plate VI, which are from photographs by H. Main, B.Sc.; Plate XVIII, fig. 3, from a photograph by G. T. Lyle; and Plate IV, fig. 1 from a photograph by the late H. F. Hayman.

In a work containing so much detail and involving so many references it would be too optimistic to expect that no error has escaped notice; but if the corrigenda have been reduced to a minimum, the result should be attributed to the assiduity with which the late Secretary of the Ray Society, Mr. J. Hopkinson, brought his great experience to bear in piloting the book along its passage through the press.

W. J. LUCAS.

KINGSTON-ON-THAMES;
July, 1919.

CONTENTS.

		PAGE
Introduction		1
Sub-order I.	Forficulodea	7
Genus 1.	Anisolabis	15
2.	Labidura	20
3.	Labia	28
4.	Prolabia	35
5.	Forficula	39
6.	Apterygida	58
Sub-order II.	Blattodea	62
Genus 1.	Ectobius	73
2.	Blattella	85
3.	Blatta	93
4.	Periplaneta	100
5.	Leucophæa	111
Sub-order III.	Gryllodea	118
Genus 1.	Gryllotalpa	121
2.	Nemobius	130
3.	Gryllus	134
Sub-order IV.	Locustodea	146
Genus 1.	Pholidoptera	151
2.	Metrioptera	157
3.	Tettigonia	171
4.	Phasgonura	176
5.	Conocephalus	184
6.	Meconema	189
7.	Leptophyes	193
Sub-order V.	Acridiodea	200
Genus 1.	Tetrix	206
2.	Gomphocerus	217
3.	Mecostethus	225
4.	Stenobothrus	230
5.	Omocestus	234
6.	Stauroderus	242
7.	Chorthippus	248
Orthoptera of the Channel Islands		257
Systematic Index		259

31294

LIST OF THE PLATES.

PLATE

I.—Fig. 1.—*Mantis religiosa.* Fig. 2.—*Bacillus rossii.* Fig. 3.—*Campodea* sp. Fig. 4.—Nymphal earwig.

II.—Figs. 1–8.—Males of the British Forficulodea.

III.—Figs. 1, 2.—*Labidura riparia.*

IV.—Figs. 1–3.—*Labidura riparia.*

V.—Figs. 1–3.—*Anisolabis annulipes.* Fig. 4.—*Prolabia arachidis.* Figs. 5, 6.—*Forficula lesnei.* Fig. 7.—*Apterygida albipennis.*

VI.—Figs. 1–6.—Details of British Cockroaches. Figs. 7, 8.—*Forficula auricularia.*

VII.—Figs. 1–8.—British Cockroaches.

VIII.—Figs. 1–5.—British species of *Ectobius.*

IX.—Fig. 1.—*Periplaneta americana.* Fig. 2.—*P. australasiæ.*

X.—Fig. 1.—*Leucophæa surinamensis.* Fig. 2.—*Blatta orientalis.*

XI.—Fig. 1.—*Periplaneta americana.* Fig. 2.—*P. australasiæ.* Fig. 3.—*Leucophæa surinamensis.*

XII.—Figs. 1, 2.—*Gryllotalpa gryllotalpa.* Figs. 3, 4.—*Gryllus domesticus.*

XIII.—Figs. 1, 2.—*Nemobius sylvestris.* Fig. 3.—*Gryllus campestris.*

XIV.—Figs. 1–9.—Females of British Locustodea.

XV.—Figs. 1, 2.—*Pholidoptera griseoaptera.* Figs. 3, 4.—*Conocephalus dorsalis.*

PLATE
XVI.—Figs. 1–3.—British species of *Metrioptera*.
XVII.—Fig. 1.—*Tettigonia verrucivora*. Fig. 2.—*Phasgonura viridissima*. Figs. 3, 4.—*Leptophyes punctatissima*. Fig. 5.—*Meconema thalassinum*.
XVIII.—Figs. 1, 2.—*Phasgonura viridissima*. Fig. 3.—*Meconema thalassinum*.
XIX.—Figs. 1–8.—British Gomphocerids and Stenobothrids.
XX.—Figs. 1–9.—Elytra of males of British Acridiodea (except *Tetrix*).
XXI.—Figs. 1, 2.—British species of *Tetrix*.
XXII.—Figs. 1, 2.—*Mecostethus grossus*.
XXIII.—Fig. 1.—*Tetrix subulatus*. Figs. 2, 3.—*Gomphocerus maculatus*. Figs. 4, 5.—*G. rufus*. Fig. 6.—*Omocestus rufipes*. Fig. 7.—*Chorthippus parallelus*. Fig. 8.—*Stenobothrus lineatus*. Fig. 9.—*Chorthippus elegans*.
XXIV.—Figs. 1, 2.—*Omocestus viridulus*.
XXV.—Figs. 1, 2.—*Stauroderus bicolor*.

ILLUSTRATIONS IN THE TEXT.

FIGS.		PAGE
1.	—Dorsal and ventral view of a generalised earwig	8
2.	—Callipers of British earwigs, males	10
3.	—Deformed callipers of British earwigs	11
4.	—Extremity of abdomen of *Labia minor*, male	30
5.	—Antenna of *Labia* and *Prolabia*	36
6.	—Wing of *Forficula auricularia*	41
7.	—Egg of *F. auricularia*	41
8.	—Apex of abdomen of *F. auricularia*, male	41
9.	—Apex of abdomen of *F. auricularia*, female	41
10.	—Pronota of British *Ectobii*, males	64
11.	—Mid leg of *Periplaneta australasiæ*	64
12.	—Elytron and wing of *Periplaneta americana*	65
13.	—Oötheca of certain cockroaches	68
14.	—*Ectobius lapponicus* and details	75
15.	—*Blattella germanica*	88
16.	—*Blatta orientalis*	95
17.	—*Periplaneta australasiæ*	106
18.	—Fore leg of *Gryllotalpa gryllotalpa*	123
19.	—Ovipositors of British Locustodea	148
20.	—Egg of *Leptophyes punctatissima* and of *Metrioptera albopunctata*	159
21.	—Apex of abdomen of *Meconema thalassinum*, male	190
22.	—Pronota of British Acridiodea	202
23.	—Elytron and wing of an Acridian grasshopper	204
24.	—*Tetrix subulatus*	209
25.	—Ovipositor of *Stenobothrus lineatus*	233

BRITISH ORTHOPTERA.

INTRODUCTION.

In the Orthoptera we have one of those orders of insects which have frequently been spoken of as "neglected," and the reason for the use of the term is not far to seek. Many—perhaps too many—of those who take an interest in any division of the insect-world, do so with almost the sole object (in itself laudable enough no doubt) of forming a collection of specimens that shall delight the eye by their pleasing appearance. Even when they breed the insects on which their choice has fallen, they do so in order to fill up with perfect specimens the ranks in their cabinets. To these, such groups as the Orthoptera can scarcely be expected to appeal.

Others there are who capture and breed insects with the object of ascertaining what may be learnt of their habits, of discovering the life-history both of the individual and of its race, of tracing the relationships that exist, or have existed, between insect-races extant or extinct, or with some other scientific purpose in view. To the notice of these our Orthoptera may with confidence be presented. Let it be added also, that as the specimens increase in number, many of them possessing in one way or another an individuality of their own, the collection will soon become as pleasing in the eyes of its compiler as any formed of the more showy members of the insect-race.

Perhaps, however, *the* great point in favour of the

Orthoptera as an Order of Insects worthy of study is the fact that, leaving out the Protura, Zoraptera, Collembola, Campodeioidea, and Thysanura, this Order probably contains the oldest insects which have survived to the present geologic age.

In support of this statement it is sufficient here to point to their geologic record, the slight post-embryonic development which they display, the frequent absence or rudimentary condition of the elytra and wings, and the mandibulate mouth. Another point testifying apparently to the antiquity of the Order is the presence of cerci—resembling posterior antennæ, and no doubt in some cases useful as such—throughout the British species. These cerci are very characteristic of the apterous insect *Campodea staphylinus* (Plate I, fig. 1), which may, or may not, be an extremely primitive insect come down to our time, but at any rate is of an early type.* This simple insect calls to mind a newly-hatched and therefore wingless earwig (Pl. I, fig. 2) in which the callipers (cerci) are proportionately much longer and simpler than they are in the imago.† It should be noticed that they are present also in other ancient Orders, such as the Plecoptera, Odonata, and Ephemeroptera.

Probably 10,000 species, which has been given as an estimate of the total number of Orthoptera living at the present day, is a very modest guess. About 500 are inhabitants of Europe, while of those which may reasonably be considered British, there is an interesting group containing the rather small total of 39 species, only a few of which extend their range into Scotland. Not even all of these 39 can be looked upon as indigenous, though such as are not are so far naturalised as to breed here and thus establish their

* See 'Origin and Metamorphoses of Insects,' by the Right Hon. Lord Avebury, 1902.

† C. J. Gahan's recent detection of joints in the callipers of an embryonic earwig, and their presence in the nymph of a Ceylon earwig, *Dyscritina longisetosa*, Westw. (= *gerstæckeri* Dohrn), investigated by E. E. Green, strengthen this conclusion. See 'Trans. Ent. Soc. Lond.,' 16 Mar. 1898; and Burr's "Dermaptera," in 'Fauna of British India,' p. 11, 1910.

right to inclusion in our list. A considerable number of others are met with casually, but can in no sense be looked upon as British insects. As regards status, then, our Orthoptera may thus be tabulated :—

a. Thirty-one species considered to be indigenous.
b. Eight aliens—naturalised, however, as shown by their breeding here.
c. An uncertain but large and increasing number of casual visitors—interesting, of course, but whose names must not appear on our lists.

In order to show the position of the Order Orthoptera within the Class Insecta, the scheme of Insect Orders adopted is here given* :—

Apterygota (wingless insects, supposed to have descended from wingless ancestors) : Order 1, Protura ; 2, Zoraptera ; 3, Collembola † ; 4, Campodeioidea ; 5, Thysanura.

Anapterygota (wingless insects, whose ancestors were probably winged) : Order 6, Mallophaga ; 7, Anoplura ; 8, Siphonaptera.

Exopterygota (winged insects, whose wings develop outside the body, these Orders still containing a fair number of wingless, or imperfectly winged, forms). Order 9, Orthoptera ; 10, Plecoptera ; 11, Psocoptera ; 12, Isoptera ; 13, Embioptera ; 14, Ephemeroptera ; 15, Paraneuroptera (= Odonata) ; 16, Thysanoptera ; 17, Hemiptera.

Endopterygota (winged insects, whose wings arise as invaginations of the hypodermis, and for a time project within the body, containing but few wingless forms). Order 18, Neuroptera ; 19, Trichoptera ; 20, Lepidoptera ; 21, Coleoptera ; 22, Strepsiptera ; 23, Diptera ; 24, Hymenoptera.

We may define the Orthoptera (ὀρθος = straight ; πτερον = a wing) as : *Insects with mouth formed for biting, the maxillary and labial palpi being conspicuous and the labium being divided in the middle ; the fore-wings (elytra, or tegmina) stiff but not horny, closed over*

* Compare "The Orders of Insects," D. Sharp, 'Entomologist,' vol. xlii, p. 270, 1909.

† It is possible that one or two of the Apterygote groups should not be classed with Insects proper.

the back and usually protecting the delicate hind-wings, which are folded fanwise and in certain cases transversely also; elytra and wings often rudimentary or absent; growth a continuous process, abrupt metamorphoses being absent, the young (nymphs) much resembling their parents, except for the wings, which gradually appear, wrapped in small cases, and increase in size at each new ecdysis; no real pupal instar.

Although there are very distinct sections of the Orthoptera, yet the Order as a whole is fairly well defined, and few systematists seem to wish to readjust the boundaries. The only doubtful point in reality appears to be whether or not the earwigs should be separated from the rest as a distinct Order. In the present case it was not thought expedient to segregate a group which appears to have sufficient points of connection with the cockroaches to justify their being placed near them. Further, if the earwigs are treated as an Order there seems to be no sufficient reason why the cockroaches and some other divisions should not be treated in a similar way, and this would be inconvenient, if right. Handlirsch* has done so, it is true, in a work in which he deals with fossil insects as well as recent ones; but it can be justified only if the same amount of subdivision is undertaken in certain other Orders—the Hymenoptera for instance. Leach not only separated the earwigs, as Dermaptera, but also constituted the cockroaches a distinct Order, as Dictyoptera. On the other hand some entomologists —Grassi, Oudemans, Finot, Minert, for example— would add the Thysanura, or part of them, to the Orthoptera, while others would include the Odonata, if not other insects also.

At the same time, within the Order as usually defined, it is necessary to distinguish clearly the groups which exist in Nature, and for these Brunner's nomenclature has been adopted, making, however

* A. Handlirsch, 'Die fossilen Insekten und die Phylogenie der rezenten Formen,' Leipzig, 1908.

(which he did not), the Earwigs correspond with the others; and this is more fully justified now that the Hemimeridæ and the Arixeniidæ have to be associated with them.

These groups* (or sub-orders) are:

1. Forficulodea (Earwigs, with *Arixenius* and *Hemimerus*).
2. Blattodea (Cockroaches).
3. Mantodea (Soothsayers, or Praying Insects).
4. Phasmodea (Leaf- and Stick-Insects).
5. Gryllodea (Crickets).
6. Locustodea (Long-horned Grasshoppers).
7. Acridiodea (Short-horned Grasshoppers).

From the fact that the members of the first four groups use their legs for running or walking, while the last three are adepts at jumping, the former are often spoken of as Cursoria, while the latter are named Saltatoria. The groups of the Cursoria are very distinct one from another, the three groups of the Saltatoria on the other hand being much more closely related.

Mantodea and Phasmodea are not represented in the British fauna, although *Mantis religiosa* Linn. (Plate I, fig. 3) and a Phasmid, *Bacillus gallicus* Charp. (*vide* Pl. I, fig. 4) ascend as far north as Central France.

Flight is not usually a striking characteristic of the Orthoptera, although there are important exceptions. They usually run, walk, or hop, while the wings are often abortive and nothing more than musical organs: not seldom they are absent altogether. "Singing" is, however, practically confined to the Saltatoria, the Cursoria being silent or nearly so.

A list of the British Orthoptera follows.

* Boliver subdivides the Orthoptera thus:

Section i. Dermaptera . .	Fam. Forficulidæ.
Section ii. Dictyoptera . .	Fam. Blattidæ and Mantidæ.
Section iii. Euorthoptera . .	Fam. Phasmidæ, Acridiidæ, Gryllidæ and Locustidæ.

Order ORTHOPTERA.

Sub-order I. FORFICULODEA. (Earwigs.)

Genus 1. Anisolabis *Fieber.*
1. A. annulipes *Lucas.*
„ 2. Labidura *Leach.*
1. L. riparia *Pallas.*
„ 3. Labia *Leach.*
1. L. minor *Linn.*
„ 4. Prolabia *Burr.*
1. P. arachidis *Yersin.*
„ 5. Forficula *Linn.*
1. F. auricularia *Linn.*
2. F. lesnei *Finot.*
„ 6. Apterygida *Westwood.*
1. A. albipennis *Megerle.*

Sub-order II. BLATTODEA. (Cockroaches.)

Genus 1. Ectobius *Stephens.*
1. E. lapponicus *Linn.*
2. E. perspicillaris *Herbst.*
3. E. panzeri *Stephens.*
„ 2. Blattella *Caudell.*
1. B. germanica *Linn.*
„ 3. Blatta *Linn.*
1. B. orientalis *Linn.*
„ 4. Periplaneta *Burmeister.*
1. P. americana *Linn.*
2. P. australasiæ *Fabricius.*
„ 5. Leucophæa *Brunner.*
1. L. surinamensis *Linn.*

Sub-order III. GRYLLODEA. (Crickets.)

Genus 1. Gryllotalpa *Latreille.*
1. G. gryllotalpa *Linn.*
„ 2. Nemobius *Serville.*
1. N. sylvestris *Fabricius.*
„ 3. Gryllus *Linn.*
1. G. campestris *Linn.*
2. G. domesticus *Linn.*

Sub-order IV. LOCUSTODEA. (Long-horned Grasshoppers.)

Genus 1. Pholidoptera *Wesmael.*
1. P. griseoaptera *De Geer.*
„ 2. Metrioptera *Wesmael.*
1. M. albopunctata *Goeze.*
2. M. brachyptera *Linn.*
3. M. roeselii *Hagenbach.*
„ 3. Tettigonia *Linn.*
1. T. verrucivora *Linn.*
„ 4. Phasgonura *Stephens.*
1. P. viridissima *Linn.*
„ 5. Conocephalus *Thunberg.*
1. C. dorsalis *Latreille.*
„ 6. Meconema *Serville.*
1. M. thalassinum *De Geer.*
„ 7. Leptophyes *Fieber.*
1. L. punctatissima *Bosc.*

Sub-order V. ACRIDIODEA. (Short-horned Grasshoppers.)

Genus 1. Tetrix *Latreille.*
1. T. subulatus *Linn.*
2. T. bipunctatus *Linn.*
„ 2. Gomphocerus *Burmeister.*
1. G. rufus *Linn.*
2. G. maculatus *Thunberg.*
„ 3. Mecostethus *Fieber.*
1. M. grossus *Linn.*
„ 4. Stenobothrus *Fischer.*
1. S. lineatus *Panzer.*
„ 5. Omocestus *Bolivar.*
1. O. rufipes *Zetterstedt.*
2. O. viridulus *Linn.*
„ 6. Stauroderus *Bolivar.*
1. S. bicolor *Charpentier.*
„ 7. Chorthippus *Fieber.*
1. C. elegans *Charpentier.*
2. C. parallelus *Zetterstedt*

Order ORTHOPTERA.

Sub-order I. FORFICULODEA.
(Earwigs.)

*Dermaptera** Leach Edin. Encycl. ix	1815.
Forficulidæ Steph. Cat. Brit. Ins. Vol. I, p. 299	1829.
,, Steph. Illustr. Brit. Ent. Vol. VI, p. 3	1837.
Forficulina Newm. Ent. Mag. Walker, Vol. 2, p. 424	1834.
Dermatoptera Burm. Handb. Ent. Vol. 2, p. 743	1838.
Euplekoptera Westw. Zool. Journal, No. xix	1831.
Euplexoptera Westw. Introd. Class. Ins. Vol. 1, p. 398	1839.
Forficularia Brunner Prodr. Eur. Orth. p. 1	1882.
Forficulodea Bolivar Rev. Biol. Nord. Fr. Vol. 5, p. 477	1893.

(Other names, which have been occasionally used, it is unnecessary to quote.)

Due perhaps to the fact that in themselves the Earwigs form a well-defined natural group, there has been some considerable difference of opinion amongst entomologists with regard to their relationship to other insects. Many species in general appearance are very like beetles, and Burr speaks of *Labia minor* as flying with and mimicking certain Brachelytra.† We are not therefore surprised to find that Linnæus classed them with the Coleoptera. Some systematists consider that they should constitute a natural Order in themselves—Dermaptera, Dermatoptera, Euplexoptera. More usually, however, they have been placed with the Orthoptera, and that arrangement seems to be the more generally accepted at the present time, and withal the more reasonable also. Sharp considers the only special structural characteristics to be "the peculiar form of the tegmina and hind-wings, the imbrication of the segments, and the forceps terminating the body."‡

Apparently the geologic history of these insects does not certainly extend back beyond Tertiary times.

* De Geer had already proposed this term for the whole of the Orthoptera. 'Mem. pour serv. à l'Hist. d'Ins.' I, Orth. vol. iii, 1773.

† 'Ent. Rec.' xi, No. 2, 1899.

‡ 'Camb. Nat. Hist.' vol. v, p. 216.

An insect, *Baseopsis forficulina*, has been obtained from the Lias in Switzerland,* but entomologists generally do not consider it to be an earwig. Above the Chalk, however, in Tertiary formations of Oligo-

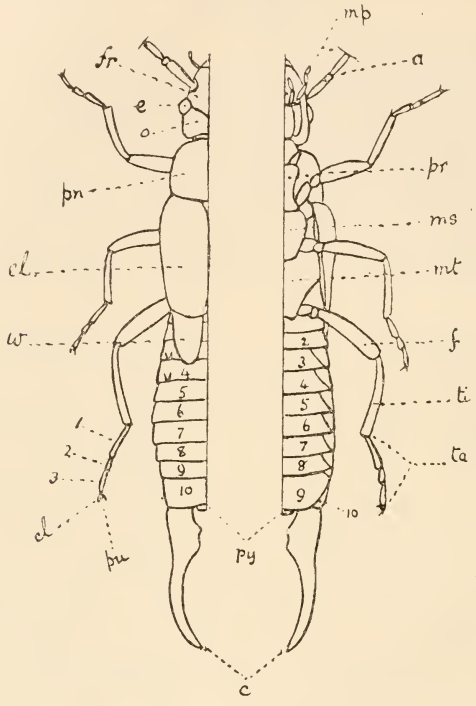


Fig. 1.—Dorsal view (A) and ventral view (B) of a generalised male earwig. A. *fr*, frons; *e*, eye; *o*, occiput; *pn*, pronotum; *el*, elytron; *w*, wing-tip; 1, 2, 3, tarsal segments; *cl*, claw; *pu*, pulvillus (seldom present); 4–10, last seven segments of abdomen. The 3rd and 4th segments carry scent-folds as indicated. B. *mp*, maxillary palpus; *a*, antenna; *pr*, prosternum; *ms*, mesosternum; *mt*, metasternum; *f*, femur; *ti*, tibia; *ta*, tarsus; 2–10, last nine segments of the abdomen; *py*, pygidium; *c*, callipers.

cene and Miocene times, earwigs certainly occur, and Scudder has not long since described a dozen species of one genus from the Lower Miocene beds of Florissant alone. Not seldom the wings were expanded,

* 'Die Urwelt der Schweiz,' by Prof. Oswald Heer, 1865.

and we gather that the insects have changed little in appearance, size, wing-form, and wing-expanse. The callipers, however, seem to have been decidedly less conspicuous than at present.

We may describe the Earwigs as: *Insects with slight post-embryonic development, the nymphs being very similar to the imagines. The hind femora are suitable for running, the tarsi being of 3 segments usually without pulvillus. They are mute, stridulating organs being absent. Their bodies are elongate, the arrangement of the segments of the abdomen being imbricate and the abdomen being terminated by cerci, which take the form of callipers. The elytra are leather-like and much smaller than the wings, these latter being folded from the base and again at the middle of the anterior margin: many species, however, are wingless. Ocelli are absent.*

In the male the number of segments of the abdomen is ten, whereas in the female there are but eight, the 8th and 9th segments being aborted and practically absent. In many earwigs, on the 4th segment at least, may be seen on each side a fold of the skin connected with scent-glands. The number of segments of the antennæ varies from about ten to fifty, and this is an important point in connection with classification. Other points are the shape of the second tarsal segment, of the pygidium (a small organ between the branches of the callipers), of the sub-anal plate, and of the segment preceding it. There is a small apical segment to the palpi, which seems to be peculiar to the Forficulodea.

No doubt the callipers (or forceps, or pincers) are the features of an Earwig which appeal first to an ordinary observer, and to the naturalist they are of interest on account of the history of their descent, and the uses to which they are put. There seems to be no doubt that they are homologous with the cerci of *Campodea*, the Cockroaches, and some other insects, but that they have been modified for special purposes. The question as to what these purposes are has given rise to some little discussion, and the discrepancies in

the various records may sometimes be due to the fact that not all species use them in the same way. Various writers have stated that they are of use in folding the wings after flight, or in opening them in readiness for it; but others have contradicted these state-

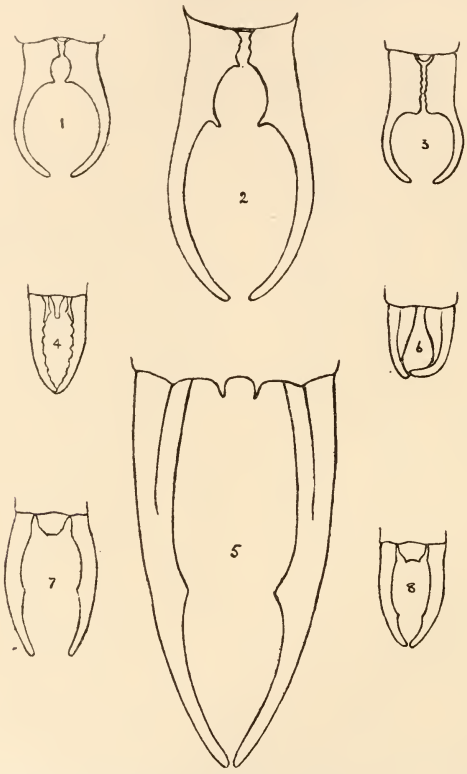


Fig. 2.—Callipers of British earwigs, males (× 5). 1. *Forficula auricularia* Linnæus. 2. *F. auricularia* var. *forcipata* Stephens. 3. *F. lesnei* Finot. 4. *Labia minor* Linnæus. 5. *Labidura riparia* Pallas. 6. *Anisolabis annulipes* Lucas. 7. *Apterygida albipennis* Megerle. 8. *Prolabia arachidis* Yersin.

ments, and the evidence seems to be conflicting (see pp. 31, 32).* They are sometimes used as weapons of offence (p. 25), and as means for the capture of prey (p. 25). Sopp suggests† that they may be employed

* M. Burr, 'Fauna of British India,' "Dermaptera," pp. 16, 17, 1910.
† E. J. B. Sopp, 'Proc. Lanc. and Ches. Ent. Soc.' 1905.

for piercing plants to cause the flow of juices, on which the insects may then feed.

This brings us to the question of food, in connection with which another interesting point arises. It is only too clear that in the garden the common earwig attacks

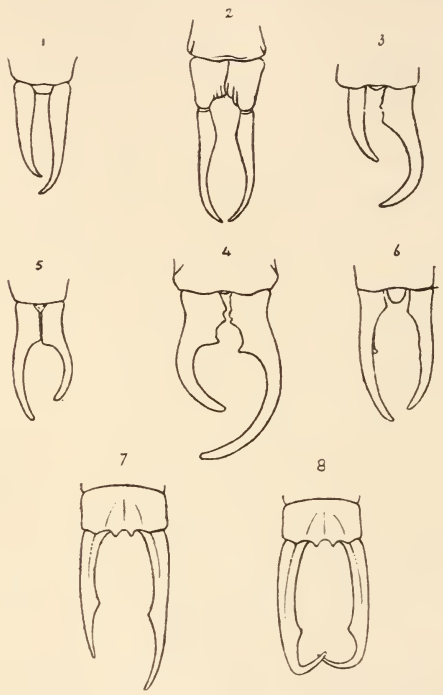


Fig. 3.—Deformed callipers of British earwigs. 1. *Forficula auricularia* Linnæus, ♀, Oxford, Apr. 1898 (× 5). 2. *F. auricularia*, ♂, Warwick, Sept. 1905 (× 5). 3. *F. auricularia*, ♂, Teddington, 11 Apr. 1908 (× 5). 4. *F. auricularia*, ♂, Deal, Sept. 1905 (× 5). 5. *Forficula lesnei* Finot, ♂, Boxhill, 1 Sept. 1898 (× 5). 6. *Apterygida albipennis* Megerle, ♂, near Dover, 7 Sept. 1908 (× 5). 7, *Labidura riparia* Pallas, ♂, Southbourne, 31 Aug. 1912 (× 2·5). 8. *L. riparia*, ♂, Southbourne, 26 Aug. 1912 (× 2·5).

the petals of dahlias and other flowers, though possibly the nectar at the base of the petals may in some cases be the real attraction. Ripe fruit is also provender to its liking, fallen or damaged examples being usually, if not always, those attacked. Yet it seems

certain that animal food, often in the form of other insects, is most natural to earwigs, and that some species feed upon it entirely (see p. 48, etc.). We might even go so far as to suggest that the common earwig may not be so entirely the gardener's enemy as it is generally supposed to be. In Hawaii earwigs were seen to destroy the sugar-cane leaf-hopper (*Perkinsiella saccharicida* Kirkaldy), one of the species so engaged being *Anisolabis annulipes*.*

Whatever may be the real state of the case in the matter of food, every naturalist ought to take a certain amount of interest in these insects, from the fact that in them the "maternal solicitude" for eggs and young shows a height of development as marked as it is unexpected in such ancient insects. Writers from De Geer (1773) onwards have commented on it, and H. Gateau de Kerville has collected much of the information, and given to the world an interesting paper on the subject.† The young, on the other hand, have been known to devour the dead body of their mother.‡

Perhaps earwigs are nauseous and not often eaten, though Newstead ('Entomologist,' 1895, p. 139) found two specimens of *Forficula* in birds' stomachs during severe weather.§ Spiders preying on earwigs, and the method of securing their prey, are referred to in 'Entom.' 1865, p. 227. Reference to parasites of earwigs will be found in Butler's 'Household Insects'; 'Entomologist,' 1876, p. 263, and 1889, p. 309; 'Ent. Mo. Mag.' 1889, pp. 282 and 459; Westwood's 'Introd. Mod. Class. Ins.' i, p. 404; H. H. Brindley's paper in 'Camb. Philos. Soc. Proc.' July, 1918; etc.

Being adepts at running, earwigs have but little occasion to use their wings, and are seldom seen to employ them. As they hide in crevices and dark corners during the day, seeking their prey at night, it

* R. C. L. Perkins, Hawaiian Gazette Co. Honolulu, 1903.

† H. G. de Kerville, 'Accouplement, œufs, et amour maternel des Forficulidés,' Rouen, 1907.

‡ Westwood, 'Mod. Class Ins.' p. 403.

§ *Vide* H. H. Brindley, 'Proc. Camb. Philos. Soc.' July, 1918.

is possible that they may, however, use their wings more frequently than is suspected.

No doubt the term "Earwig" took its rise from the fact that the creature sometimes makes use of the human ear for the sake of concealment. We should scarcely expect that this would often occur, though there are certainly authentic instances of its having done so.* This origin of the name has been objected to, and it has been suggested that the word is a corruption of "ear-wing," the hind-wings of the insect being, as a matter of fact, remarkably ear-like. It is not at all likely, however, that the popular name of an insect should be derived from a part of the creature which by an ordinary person is never seen. Further, throughout Europe it is the ear-*worm*, *-piercer*, *-borer*, or something of that kind (*vide* Westwood, 'Mod. Class. Ins.'). In origin the syllable "wig" is connected with the idea of running, in which mode of progression, as we have said before, the earwig can hold its own with most insects. Though an earwig may occasionally conceal itself in an ear, we are not to believe that it can "pass into the brain, and grow to the size of a hen's egg, setting up brain fever, from which the patient dies." We are told, on the other hand, that these insects were formerly given as a medicine to strengthen the nerves! †

Burr‡ divides the Forficulodea into eight families:

1. Arixeniidæ.
2. Hemimeridæ.
3. Pygidicranidæ.
4. Labiduridæ.
5. Apachyidæ.
6. Labiidæ.
7. Chelisochidæ.
8. Forficulidæ.

Seven species breed in Britain, and these are distributed amongst three families only—Labiduridæ, Labiidæ, and Forficulidæ. The Labiidæ contain *Labia minor* and *Prolabia arachidis* (both in sub-family

* Kirby, 'Text-book of Entomology,' p. 82. It might be well to state that an earwig, or any other insect, may be dislodged by pouring oil into the ear.

† Webster, 'Proc. Lanc. and Ches. Ent. Soc.' 1903.

‡ M. Burr, 'Genera Insectorum,' Fascicule 122, Dermaptera, 1911.

Labiinæ). The Labiduridæ contain *Anisolabis annulipes* (sub-family Psalinæ) and *Labidura riparia* (sub-family Labidurinæ). The Forficulidæ contain the other three species—*Forficula auricularia*, *F. lesnei*, and *Apterygida albipennis* (all in sub-family Forficulinæ). Of these *A. annulipes* and *P. arachidis* are not natives of Britain. There is little likelihood of the list of indigenous species being increased, though *Chelidurella acanthopygia* Géné may perhaps turn out to be British. It should be sought for under stones on hills and mountains.* The South-west of Ireland might possibly also yield something new if it were thoroughly explored.

Females of *Prolabia arachidis*, *Apterygida albipennis*, and *Forficula lesnei* are very much alike; but the males and remaining females may be easily separated with the help of the following artificial table:—

A. Males without flattened base to callipers.
  a. Elytra and wings present.
    i. Size very large; colour pale ochreous . . . . *L riparia*.
    ii. Size very small; colour dark brown . . . . *L. minor*.
  b. Elytra present, wings absent; size moderate; colour brown.
    i. Tooth near apex of callipers of male . . . *P. arachidis*.
    ii. Tooth near middle of callipers of male . . . *A. albipennis*.
  c. Elytra and wings absent.
    i. Colour black; right branch of callipers of male more curved than left . . *A. annulipes*.
B. Males with flattened base to callipers.
  a. Size moderate; colour brown.
    i. Elytra and wings present . *F. auricularia*.
    ii. Elytra present; wings absent . . . . *F. lesnei*.

* M. Burr, 'Entomologist,' vol. xxxi, 1898, pl. ii, p. 125. Notes on the insect are given, and both male and female are figured on a large scale.

Genus 1. **ANISOLABIS** Fieber.

Anisolabis Fieber Lotos, vol. 3, p. 257 . . . . . 1853.
Forcinella Dohrn Stett. Ent. Zeit. vol. 23, p. 226 . . . 1862.
Brachylabis ibid. vol. 25, p. 292 (*partim*) . . . . . 1864.

Description.—Antennæ 15–25 segments. Pronotum nearly square. Elytra and wings wanting. Legs somewhat short, but broad. Abdomen usually stout and rather long. Lateral scent-folds sometimes missing, but in other cases pronounced. Callipers of male either straight, in contact, and tapering; or, strongly curved, the right branch often more so than the left; callipers of female straight, in contact, and tapering.

The genus, even as now restricted, contains nearly fifty species, and is well distributed throughout the world. There are two European representatives, *A. annulipes* Luc. which is naturalised in some places in Britain, and *A. maritima* Bon. which has occurred here casually.

1. **Anisolabis annulipes** Lucas (H.).

(Plate II, fig. 4, and Pl. V, figs. 1–3.)

annulipes Lucas (H.) Ann. soc. ent. de France, sér. 2, V, p. lxxxiv . . . . 1847—*Forficesila.*
„ Fischer Orth. Europ. p. 69, Tab. vi, fig. 6 . . . . . 1853—*Forficula.*
„ Dohrn Stett. Ent. Zeit. vol. XXV, p. 290 1864—*Forcinella.*
„ Brunner Prodr. Eur. Orth. p. 8 . . 1882—*Anisolabis.*
„ Finot Faune de la France, Orth. p. 64 . 1889—*Anisolabis.*
„ Swale Ent. Mo. Mag. p. 124 . . 1894—*Anisolabis.*
„ Burr Brit. Orth. p 14, pl. i, f. 3 . . 1897—*Anisolabis.*
„ Walker Ent. Mo. Mag. p. 280 . . 1897—*Anisolabis.*
„ Lucas (W. J.) Entom. p. 125, with fig. 1897—*Anisolabis.*
Annulipes Kirby Syn. Cat. Orth. i, p. 18 . . 1904—*Anisolabis.*
annulipes Burr Syn. Orth. W. Eur. p. 5 . . 1910—*Anisolabis.*
„ Burr Fauna Br. Ind. Dermap. p. 84, fig. 24 . . . . . 1910—*Anisolabis.*
„ Burr Wytsman's Gen. Ins. Fascic. 122, p. 29 . . . . . 1911—*Anisolabis.*
„ Lucas (W. J.) Proc. S. Lond. Ent. Soc. p. 25, pl. iv and v . . . . 1912—*Anisolabis.*

(Burr (Genera Insectorum) gives the following synonyms:—*bormansi* Scudder; *antoni* Dohrn; *antennata* Kirby; *annulicornis* Blanchard; *variicornis* Smith.)

Original Description.

Cette Forficésile que j'ai rencontrée à Paris n'est probablement pas indigène, je l'ai trouvée au Jardin-des-Plantes, cachée sous quelques plâtras à la base d'un mur assez humide. J'attribue la découverte de cette espèce, qui est nouvelle, à l'arrivée de caisses provenant de l'Amerique du nord. J'ai cherché à la rapporter aux espèces décrites par les auteurs, mais je n'ai trouvé aucune description qui puisse lui appartenir. La description que je donne de cet insecte à été faite sur le vivant, et à cause de la singularité qui présentent les organes de la locomotion au sujet de la disposition des couleurs, je propose de designer ce forficulien sous le nom de :—

Forficesila annulipes. Luc.

Long. 15 millim. Larg. 3 millim. ½.

F. atra ; antennarum primo articulo rufescente duobus antepenultimis testaceis ; capite posticè transversim unisulcato, prothorace, mesothorace, metathoraceque testaceo marginatis, hoc longitudinaliter unisulcato ; abdomine subtilissimè punctulato, segmentis ad basim ferrugineo sublimbatis ; ebelis validis, subcurvatis intrà sensiter denticulatis ; pedibus flavotestaceis, femoribus tibisque fusco-annulatis.

La tête est d'un noir brillant, lisse et présente postérieurement un sillon transversal assez profondément marqué et légèrement en forme de croissant ; en dessous elle est d'un fauve-roussâtre avec sa partie antérieure bordée de testacé. Les yeux sont d'un noir-mat. La lèvre supérieure est d'un brun-roussâtre ainsi que les mandibules ; quant aux palpes maxillaires et labiaux, ils sont d'un roux légèrement teinté de brun, avec les articles qui composent ces organes annelés de testacé. Les antennes sont noirs, à l'exception cependent du premier article qui est d'un roux-clair, et des deux avant-derniers qui sont testacés. Le prothorax, est d'un noir brillant, bordé sur les parties latérales, ainsi qu'à la base, de testacé ; il est lisse et offre dans sa partie médiane un sillon longitudinal assez fortement accusé, qui n'atteint pas tout à fait la base, laquelle est sensiblement déprimée ; le mésothorax et le métathorax sont de même couleur que le prothorax, avec leur base seulement finement bordée de testacé-roussâtre ; l'abdomen est noir, très finement ponctué, avec tous les segments teintés à leur base de ferrugineux, à l'exception cependant du dernier qui est entièrement noir, et qui présente postérieurement un sillon longitudinal assez bien marqué ; en dessous l'abdomen est d'un brun-ferrugineux ; quant aux pinces, elles sont noires, robustes, peu courbées, assez penchées en dessous et sensiblement denticulées à leur côté interne. Les pattes sont courtes, robustes, d'un jaune-testacé, avec les fémurs et la naissance des tibias annelés de brun-foncé ; pour les tarses, ils sont roussâtres, avec leurs crochets ferrugineux.

Cette espèce dont je n'ai trouvé qu'un seul individu était aptère ; je l'ai prise vers le milieu de septembre. (H. Lucas, 'Ann. soc. entom. de France,' sér. 2, v, p. lxxxiv.)

Male Imago (Pl. II, fig. 4).—*Size* moderate ; general *colour* shining black. *Length** about 11 mm., greatest *width* about 3 mm., *length of callipers* about 2 mm. *Head* black. *Antennæ* of 16 segments, a few

* "Length" means total length, including the callipers, in all the earwigs.

basal ones reddish, then several very dark, the 13th and 14th quite pale, the apical two again dark (Pl. V, fig. 2). *Pronotum* squarish, lateral margins lighter, anterior half sometimes lighter also. *Elytra* and *wings* entirely absent. *Abdomen* sub-parallel, without scent-folds on the basal segments; the last dorsal segment larger, with depressed medial line. *Legs* flattened, testaceous; femora and tibiæ with a dark band. *Callipers* (Pl. V, fig. 3, and text-fig. 2, no. 6) nearly in contact at base, short, stout, without teeth, but with slightly wrinkled inner margin, the right branch more incurved at the tip than the left.

Female Imago (Pl. V, fig. 1).—Resembling the male rather closely; usually, however, 2 or 3 mm. longer. *Callipers* also longer, measuring about 3·4 mm. The two branches of the callipers alike, and throughout their length more nearly contiguous than in the male. The number of visible segments of the abdomen, being two less than in the male, will be found a useful feature for distinguishing the sexes.

Egg.—Burr ('Record,' 1912, p. 80) says that he found numbers of *A. annulipes* under stones in a dry river-bed just outside Funchal in Madeira. This was on 30 September. They generally occurred in pairs, the female in three instances sitting in an apparently dug-out depression in the earth, taking care of a pile of about a dozen small oval cream-coloured eggs, a little less than 1 mm. in length.

Nymph.—As the species possesses neither elytra nor wings, the nymph is more than usually like the imago, unless it is so young as to be markedly less in size. Perhaps a browner colouring may be a nymphal characteristic.

Variation.—Apart from considerable difference in size between individual specimens, the greatest amount of variation occurs in the dark bands on the legs, these bands, indeed, being often entirely absent. It is, therefore, unfortunate that the specific name should

have been bestowed in reference to this point. In the antennæ the number of reddish segments varies considerably and in consequence so does the number of black ones; occasionally the pale segments are increased to three, or reduced to one. The pronotum is sometimes almost entirely dark.

Date.—In the south of France, where *A. annulipes* occurs in a wild state, it is found in the summer and autumn. Living under artificial conditions in this country, no doubt imagines may always be found; probably also breeding is more or less continuous.

Habits.—After reading the "Entomology of a London Bakehouse" in the April number of the 'Ent. Mo. Mag.' in 1894, H. Swale visited the oldest bakehouse in Tavistock to search for insects. Amongst the ashes under the furnace were great numbers of an earwig, unlike any he had previously seen. Several were taken home, and Saunders, to whom a specimen was submitted, referred it to *Anisolabis annulipes*, Lucas,—a species not before recorded for Britain. The bakers said they had always seen them there, so they must have arrived some years before. Whence did they come? * On 27 Oct. 1896 Swale sent me two specimens, and said that they had their nests in the crevices of the pillars which support the oven and in the floor. He stated that it was a very difficult hunting-ground and that a collector was not particularly welcomed by the baker. Writing to Burr in November of the same year Swale said that they were less numerous than they had been, and that he was going to leave them to propagate a little. C. W. Bracken told me (*in litt.* 1913) that the bakehouse was pulled down; so presumably the

* Swale made out that they were first observed about 1885. In 1916 Bracken solved the "mystery" (as Burr called it) of the occurrence of *A. annulipes* in Tavistock. It appears that some years before 1894, when Swale first found the earwigs, the father-in-law of the occupant of the bakehouse was a Jamaica merchant, who, visiting his daughter, brought the insects in his luggage. They formed a colony in the bakehouse just behind the house.

Tavistock colony has died out. The house attached to the bakehouse was still standing in 1916.

In 1897 Commander J. J. Walker R.N. found an immature earwig in the Chemical Works at Queenborough in Kent, which Burr considered to be *A. annulipes*. In September and October Walker obtained mature examples, which confirmed the identity of the insect. They were found in one place in the yard of the works amongst bones and rubbish under some old sacks and barrels. In April, 1898, he could not find the species and concluded that the floods of November, 1897, had brought the colony to an end. This, however, was not the case, for in September, 1904, he was able to send me a couple of specimens, and in 1906 he sent others from the "sack-heaps" and said that the species was commoner than he had seen it before. As these sacks are to some extent decomposing there is perhaps a temperature above the normal, as there would be in a manure-heap. In August, 1909, Walker found it as usual.

On more than one occasion the species has reached Kew Gardens. That it has not established itself there may be due to the war that is waged against such intruders (see 'Entomologist,' 1897, p. 125).

At the end of March, 1900, E. C. Bedwell, while searching for beetles in a soap-works at Bow in the East End of London, found *Anisolabis annulipes* established there. They seemed to be living under very similar conditions to those that obtain with the Queenborough insects, these also being found amongst bones and in company with *Prolabia arachidis* as at Queenborough (see 'Entomologist,' 1900, p. 157).*

Finally in November, 1910, in a bakery at Coatbridge in Scotland G. A. Brown obtained an earwig which he subsequently found to be *Anisolabis annulipes*. A further search yielded a number of specimens including one or two nymphs. He thinks they would be found elsewhere under similar conditions.

* Recently a colony has been discovered in Cheshire.

Whether this insect is destined to become thoroughly established in Britain is uncertain, and time alone will show; but the tendency seems to be towards a condition similar to that of the house-cricket and the kitchen-cockroach.

Distribution.—Finot says ('Faune de la France,' "Orthoptera," p. 65): "Cette espèce, assez rare, habite les parties les plus chaudes du littoral de la Provence, pendant l'été et l'automne. Elle se tient sous les pierres et les débris." In addition it is found in Sicily, at Genoa and Pegli in Italy; it is common in the south and east of Spain; and it also occurs commonly in the Island of Madeira (Burr). In India and Ceylon it is found also; in fact it is cosmopolitan, being practically a universally distributed species.

British Localities.

England.—*Devon:* Tavistock, in a bakehouse, first in 1894 (*Swale*). *Kent:* Queenborough, chemical works, 1897 onwards (*Walker*). *London:* Bow, soap-works, March, 1900 (*Bedwell*). *Surrey:* Kew Gardens—5 Apr. 1897, received two, known to have come with plants from India; 9 Apr. 1897, received one small specimen (probably this species), which came in sugarcane from Mauritius in August, 1894; 26 Oct. 1898, received one small specimen (probably this species), which was found in a case from Penang (*Lucas*). *Cheshire:* Acton Bridge—in a bone-works, Oct. 1916 (*Tomlin*). *Derbyshire:* 1863, several, Bass' Brewery, Burton; whether it breeds there is uncertain (*E. Brown*).

Scotland.—*Lanarkshire:* Coatbridge—in a bakery, Nov. 1910 (*Brown*).

Genus 2. **LABIDURA** Leach.

Labidura Leach in Edinb. Encyc. vol. 9, p. 118 . . . 1815.
Forficesila Serville in Ann. Sci. nat. vol. 22, pp. 32, 34 . . 1831.
Demogorgon Kirby in Journ. Linn. Soc. Lond. Zool. vol. 23, p. 513 1891.

Description.—Antennæ from 20 to 36 segments. Pronotum nearly square. Elytra well developed, but wings not always so. Body rather long and flat;

scutellum and pygidium hidden; no lateral scent-folds to abdomen. Callipers of male long, somewhat slender, remote at base; of female, straight and nearly in contact. There are two European species, of which one, *L. riparia*, the type of the genus, is British.

1. **Labidura riparia** Pallas.

(Plate II, fig. 2, and Pls. IV and V.)

riparia	Pallas Reise durch verschiedene Provinzen des Russischen Reiches in den Jahren 1768–74 (St. Petersburg), II Anhang, p. 727	1773—*Forficula.*
„	Fischer de W. Orth. Ross. p. 46 . .	1846—*Forficesila.*
„	Dohrn Stettin entom. Zeit. xxiv. pp. 313–316	1863—*Labidura.*
„	Brunner von W. Prod. der Eur. Orth. p. 5, f. 1	1882—*Forficula.*
„	Shaw Ent. Mo. Mag. p. 356 . . .	1889—*Labidura.*
„	Finot Faune de la France, Orth. p. 62, ff. 28 & 29	1889—*Labidura.*
„	Burr Brit. Orth. p. 12. pl. I, f. 1 . .	1897—*Labidura.*
Riparia	Kirby Syn. Cat. Orth. i, p. 10 . .	1904—*Labidura.*
riparia	Lucas Entom. xxxviii, p. 267 . . .	1905—*Labidura.*
„	Burr Syn. Orth. W. Eur. p. 3 . .	1910—*Labidura.*
„	Burr Fauna Brit. India, Derm. p. 99 .	1910—*Labidura.*
„	Burr Gen. Ins., Fasc. 122, p. 36 . .	1911—*Labidura.*
„	Lucas Proc. S. Lond. Ent. Soc. p. 21, pl. iv, f. 2	1912—*Labidura.*
pallipes	Fabr. Syst. ent. p. 270; Ent. syst. II, p. 5	1775—*Forficula.*
gigantea	Fabr. Mant. ins. i, p. 224 . . .	1787—*Forficula.*
„	Leach Edinb. Encycl. ix, p. 118 . .	1815—*Labidura.*
„	Steph. Brit. Entom. Mandibul. vi, p. 8	1835–7—*Labidura.*

(Burr (Genera Insectorum) gives also the following synonyms:—*bilineata* Herbst; *maxima* Villers; *morbida* Serville; *distincta* Rodzianko; *dubronii* Borg; *karschi* Borg; *mongolica* Rehn; *longipennis* Borelli; *herculeana* Fabr.; *bivittata* Klug; *terminalis* Serville; *bicolor* and *fischeri* Motschulsky; *sinensis* Burr; *affinis* Guérin and Ménéville; *amurensis* Mots.; *auditor* Scudder; *clarki* Kirby; *granulosa* Kirby; *marginella* Costa; *saturalis* Burm.; *huseinæ* Rehn; var. *inermis* Brunner; var. *mixta*, Bolivar; var. *herculeana* Semenoff; var. *dumonti* Azam.; but these do not exhaust the list.)

Original Description.

75. *Forficula riparia.*

F. auricularia duplo major, pallide grysea, molliuscula. Thorax marginatus, fasciis duabus longitudinalibus fuscis, per elytra et alulas (elytris paulo longiores) continuatis. Caput vertice testaceum, oculis

fuscis. Abdomen medio dorso fuscum. Segmentum ultimum magnum, durum, pallide gryseum, margine postico inter forfices bidentato. Forfices rectiusculi, subulati, apice fuscescentes, dente unico circa medium. Pedes et antennæ pallidissima. Habitat in ripis præruptis, arenosis, præcipue ad Irtin copiosissima, canalibus horizontalibus latens. (Pallas, 'Reise versech. Prov. Russ. Reich.' II, Anhang, p. 727, 1773.)

Male Imago (Pl. III, fig. 1).—*Size* very large. General *colour* pale greyish ochre; under surface pale, except abdomen which is the same as that of the upper surface. (Being of this dirty cream-colour, with darker markings in places, these earwigs are extremely well protected by resemblance to the sand on which they live in their British habitat.) The *head* pale ochreous; *eyes* dark brown; *antennæ* yellowish, of 27–30 segments; *pronotum* brown, with pale margins and centre. *Elytra* (closed) with a large orange-yellow V on a brown ground; sides pale; small *wing-tips* pale with a darker centre; *legs* very pale. *Abdomen* with a mid-dorsal, darker, interrupted, longitudinal band; surface rather rough; last segment with a projection above the insertion of each branch of callipers and with two points between them. Legs of *callipers* bowed and bearing internally a tooth between the centre and the apex (fig. 2, no. 5); colour ruddy-brown, dark towards the apex. Length, 19–30 mm.; length of callipers, 8–13 mm.

Female Imago (Pl. III, fig. 2).—General *colour* as in male. Mid-dorsal band more pronounced on abdomen. No points between branches of callipers, which are shorter and without tooth. *Length*, 25–28·5 mm.; length of callipers, about 6·5 mm.

Nymph.—One taken 12 Aug. 1914 was very pale, the point of the face and the tips of the callipers being slightly darker, and the eyes quite dark. In the nymph the rudimentary wings show very distinctly.

Variation and Aberrations.—In these earwigs there is much variation in size, build, and colour, and many forms have been described as separate species. The wings and teeth of the callipers may be missing. As

these insects become darker in drying, some apparent colour-variations may be due simply to the fact that descriptions were made from dried specimens. Brachypterous examples with reduced elytra and squared pronotum were placed by Kirby in a special genus, *Demogorgon*, but this arrangement cannot stand. Some aberrations have been noticed. An individual taken near Christchurch, Hants, on 26 Aug. 1912, had the tip of its callipers bent at an angle and turned inwards (fig. 3, no. 8), and had no wing-tips visible, while the wings themselves were either deformed or damaged. A male taken on 20 Aug. 1912 had but one visible wing-tip. On 31 Aug. 1912 a male was captured with the left branch of the callipers (fig. 3, no. 7) considerably shorter than the right one.

Date.—Most of the recorded captures in Britain have been made in July and August; but some have taken place in May and September. There seems to be no information available for making a more definite statement. Specimens of all ages are to be met with in August, one found on 27 Aug. 1904 being very small indeed. Finot says: "On trouve des individus adultes pendant presque toute l'année, sous les débris, les pierres et les paquets de goemon" ('Faune de la France').

Habits.—In the British habitat the requisite condition for the presence of *L. riparia* seems to be a slide of loose soft sand (Pl. IV, fig. 1) with some stones, preferably flat ones (some 4 or 5 inches across), lying on its surface. Often there is a burrow under the stone, into which the earwig can retreat. Sometimes their presence may be guessed by small holes in the sand leading under the stones beneath which they pass the day. When a stone is removed and the insect is exposed to the light, the hind part of the abdomen, with the callipers, is often thrown forward over the back, the earwig not trying at first to escape. This gives it a very strange appearance and seems to be a

"terrifying attitude" (Pl. V, figs. 2, 3). On one occasion a female in captivity was noticed scratching briskly with mid and fore legs in the sand that had been placed in the box with her, as if with intent to burrow. Sometimes in nature a male and a female are found under the same stone.

While alive these earwigs are of a dirty cream tint, with a little darker colouring in places, and therefore are extremely well hidden from casual observation by their resemblance to the pale yellow sand which fringes the shore. They do not, however, lay themselves open to detection, as they remain in hiding during the day. On one occasion a captured specimen was set free, when it ran very rapidly over the sand and soon found a crevice in which to hide.

Feeding of course takes place at night. Two captured in August 1908 were kept alive under observation, being fed on animal food. One ate rapidly off a small portion of kipper given to it, and was equally satisfied with whiting. It fed freely also for a time on a fragment of rabbit. Although it attacked white of egg, it appeared to have no great liking for it. On 27 September it was found to have almost entirely consumed its smaller companion, although they had been living together for some time. When food was placed in the box with it no movement was made at first, but in one or two minutes it roused itself, waved its antennæ, turned towards and then approached the food, apparently being always perfectly certain with regard to the direction in which it lay. At the beginning of December it did not appear to be feeding. After living in captivity over four months it succumbed during the Christmas season. On another occasion *L. riparia* was found to feed readily after dark on raw beef, but in the day time remained still in the darkest corner of the box, thus attesting the fact that it is a nocturnal insect. Some I kept alive in captivity (taken 27 Aug. 1904) ate rice-pudding, banana, and meat, but would not touch

grass. On one occasion, after fasting for twenty-four hours, a female seized a cinnabar-moth larva (*Euchelia jacobææ* Linn.) of fair size and commenced eating it at the head. It held the caterpillar with the callipers, and seemed to be purposely stretching it. Sometimes it appeared to experience a difficulty in getting its callipers free. Another female came up, upon which a fight with the callipers commenced between them. They went more or less backwards for the attack, the head, however, being turned a little on one side, so that they might see what they were doing. After a time two females and a nymph were eating at the same larva, but not then holding it with their callipers. Notwithstanding the fact that it was a cinnabar larva—orange and black—they ate of it greedily; but another larva of the same species put in with a male and female was not touched, although left with them all night.

Burr ('Ent. Record,' 1903, p. 262) says of a fine male kept in captivity: "One day I put a large blue-bottle in with him. As I dropped it into the bottle the earwig at once raised his forceps vertically above his back with great swiftness, and seized the blue-bottle as it fell. He gripped it firmly with his forceps, one branch of which entirely penetrated the fly; then he carried it round the bottle for a short time, probably on account of the light. I was very interested to see this use of the forceps, which form a dangerous weapon against such small creatures as other insects; the tips are very sharp. Although the fly fell in upon the earwig from behind, it was seized instantaneously, with good aim, as though he could see it coming distinctly. I noticed that the *Labidura* generally ate the soft parts of the flies which I gave it, and left the outer shell, with the feet, antennæ, etc."

On another occasion these earwigs were often noticed cleaning themselves assiduously, and they would sometimes rub their body with their legs, as if they were trying to allay irritation. If a little water

was placed in their box, they went to it and appeared to drink it greedily. In the evening they would stand on "tip-toe" as it were, quite still for a long time in the bright light under a table-lamp, whereas in the daytime they liked to hide away out of the light as much as possible. In the beginning of January these examples, though they drank readily, seldom seemed to wish to eat.

Sharp mentions ('Entom.' 1910, p. 250) a case of "maternal solicitude" which he noticed on one occasion in the Eastern Pyrenees, and ('Insecta,' i, p. 214) that "this species is said to move its eggs from place to place, so as to keep them in situations favourable for their development."

Distribution.—*L. riparia* is found on the coast in Southern Europe. In France it is common on the south coast, and has been found as far north as Brittany. It has occurred near Geneva; in Silesia, Saxony, and Thuringia; near Berlin and near Vienna. It is common in Spain and Portugal in suitable localities. In Britain it is known only from one or two spots near Bournemouth. It has been introduced into the United States, where it is found on the Gulf-coast. Other localities are S. America, India, Ceylon, Burma, Asia Minor, Transcaucasia, Carthage, Korea, Madeira, Cape Colony, Orange River Colony, Transvaal, Rhodesia, Assumption, Cargados, Carajos Islands, Chagos Islands, etc. In fact it is now cosmopolitan, although apparently a Palæarctic insect originally. Outside England it occurs on river-banks, as well as on the seashore.

British Localities.

It is unfortunate that this earwig occurs, so far as is known, only along a small part of the south coast in the neighbourhood of Bournemouth, where too it appears to be getting more scarce. This is, of course, to be expected as buildings increase around Bournemouth and Pokesdown, and the wild character of the sandy cliffs gives place to stately roads and promenades. The late C. W. Dale, writing in

1900, says that *L. riparia* was first secured by the Rev. W. Bingley on 7 July 1808. The specimens were exhibited the following November by G. B. Sowerby at a meeting of the old Entomological Society. Bingley, in a letter to the Treasurer of the Linnean Society, states that as he was walking on the beach west of Christchurch, just at the close of the evening, he saw two or three large insects running along the sand, about or rather below high-water mark, and from their size and manner he took them to be young mole-crickets. Surprised at seeing such insects in that situation, he examined them as well as the light would permit, and, by their immense forceps and size, found them to be a species of *Forficula* hitherto undescribed as British. He took home some specimens, and ascertained them to be the *Forficula gigantea* of Fabricius. Sloman, a friend of Bingley, sought for them afterwards in the same place, and found a great number concealed under large stones on the sands. The largest Bingley could secure was nearly fifteen lines in length (= about 30 mm.), exclusive of the antennæ, which measured somewhat more than half an inch. Sloman, who lived at Wick, and Lockyer of Christchurch, accompanied J. C. Dale and Dashwood to the same spot—Mount Misery —in 1818, but with no success. This earwig came to be reckoned amongst the extinct British species (its native origin being actually questioned by the Rev. W. Kirby in his 'Introduction to Entomology') until 1865, when a few were taken on the shore close to Hengistbury Head by Dosseter. The next was taken near the pier at Bournemouth, by E. Saunders, in 1874. Kemp-Welch, in an article on the great earwig ('Transactions of Dorset Field Club,' vol. viii, p. 61) records and figures a specimen in his possession as having been taken on the beach under Branksome Park, some two miles westward from Bournemouth, within the limits of Dorsetshire, on 27 May 1886, by E. Lovett of Croydon (see 'Entom.' 1900, p. 75).

In addition to these mentioned by Dale, C. A. Briggs had a male taken on the beach at Bournemouth, July 1850, by E. W. Janson, and perhaps it might be possible to find a few other records, or specimens, if it were worth while to make the attempt. No further specimen seems to have come to hand until in 1900 (about August) Major R. B. Robertson took a female, which he gave to me, near a street lamp in Pokesdown, Hants. On 17 July 1902 his daughter, Miss Nellie Robertson, took a female on the sands at the same place. A little later I received from Major

Robertson a fine pair taken on 14 Sept. 1902, and on 19 Sept. Miss Nellie Robertson sent me two males and three females, taken on the shore at Pokesdown. On 6 Aug. 1903, in company with Major Robertson's daughters, I made the personal acquaintance of *L. riparia* at Pokesdown and in about 20 minutes we took between us 16 specimens. On 19 Aug. 1903 I found several between Pokesdown and Southbourne. On 12 and 27 Aug. 1904 I again captured specimens at Southbourne, as also on 1 Aug. 1907. On 10 Aug. 1908 I took three examples, one being a very large male, near Branksome—no doubt in Kemp-Welch's locality—and A. H. Hamm took one on 12 Aug. in the same year near Boscombe. On 3 Aug. 1909 I took three specimens near Southbourne, and on 10 Aug. 1910 J. J. F. X. King and myself took one or two more at the same place. In 1912 four were obtained near Southbourne on 20 Aug., four on 26 Aug., and four more on 31 Aug. In the autumn of 1914 R. B. Good found a single female under stones at the foot of the cliff near Southbourne. After a strict search in Aug. 1918, two small nymphs only could be found. So it seems likely, as mentioned above, that, as Bournemouth extends, these earwigs may become extinct in that district in the near future, and at present we know of no other British locality. The Rev. J. G. Wood in 'Insects at Home' mentions one without date taken on the beach at Folkestone, but this appears to need corroboration. Burr says it has been taken at Bonchurch, Isle of Wight.*

From Liverpool three casuals have been recorded by E. J. B. Sopp: a male captured in an office in Castle Street, in Oct. 1893; a male (lacking the tooth in the callipers), captured in S. John's Market in July 1903; and a nymph from Williamson Square, 1902.

Genus 3. **LABIA** Leach.

Labia Leach Edinb. Encycl. ix, p. 118 . . . . . 1815.
Copiscelis Fieber Lotos, vol. 3, p. 257 . . . . . 1853.

Description.—Antennæ with elongate cylindrical segments, the fourth and fifth almost or quite as long as the third. Head smooth, tumid, parallel-sided, narrow; sutures almost or quite obsolete; posterior margin truncate; cheeks smooth, not inflated; eyes small, not so long as the basal antennal segment.

* Morey's 'Nat. Hist. of Isle of Wight,' p. 295, 1909, but I have seen no further record of it.

Pronotum subquadrate, gently widened posteriorly in macropterous forms. Elytra perfect, smooth, not keeled. Wings perfect or abortive. Abdomen parallel-sided. Legs not very long; tarsi slender, as long as the tibiæ, first and third segments about equally long, the second minute. Callipers various, generally remote in the male. Pygidium various (Burr, 'Genera Insectorum').

The genus contains about fifty species, the type *L. minor* being the only British and European representative of the genus.

1. **Labia minor** Leach.

(Plate II, fig. 1.)

minor	Linn. Syst. nat. ed. x, i, p. 423 . . .	1758—*Forficula.*
,,	Leach Edinb. encycl. viii, p. 707 . .	1816—*Labia.*
,,	Steph. Mand. vi, p. 8	1837—*Labia.*
,,	Fischer Orth. Eur. p. 70, tab. vi, f. 7*a–d* .	1853—*Forficula.*
,,	Friv. Orth. Hung. p. 46	1867—*Forficesila.*
,,	Brunner Prod. der Eur. Orth. p. 10, f. 3	1882—*Labia.*
,,	Shaw Ent. Mo. Mag. p. 357 . . .	1889—*Labia.*
,,	Finot Faune Fr., Orth. p. 65, f. 31 . .	1889—*Labia.*
,,	Burr Brit. Orth. p. 15, pl. 1, fig. 4 . .	1897—*Labia.*
Minor	Kirby Syn. Cat. Orth. i, p. 25 . . .	1904—*Labia.*
minor	Burr Syn. Orth. West. Eur. p. 5 . .	1910—*Labia.*
,,	Burr Genera Insectorum, Fasc. 122, p. 55	1911—*Labia.*
,,	Lucas Proc. S. Lond. Ent. Soc. p. 24, pl. iv, f. 1	1912—*Labia.*
minuta	Scudd. Bost. journ. nat. hist. vii, pp. 415–416	1862—*Labia.*

Original Description.

Forficula minor. 2. F. elytris testaceis immaculatis. . . . Fn. suec. 600. Forficula alis elytro concoloribus. . . . *Habitat in* Europa. (C. Linnæus, 'Systema Naturæ,' Tom. i, 1758, p. 423.)

861. FORFICULA *minor* elytris testaceis immaculatis. . . . Forficula alis elytro concoloribus. Fn. 600. . . . Habitat in sterquiliniis. . . . Descr. Dimidio minor est hæc species, colore castaneo. *Caput* et *thoraæ* nigricantia. *Elytra* et *alæ* (quæ complicatæ apice prominent) castanea; abdomen castaneum. Forceps caudæ erectior. *Antennæ* X tantum articulis, non vero XIV, uti præcedens. *Pedes* et *abdomen* subtus pallidiora. (C. Linnæus, 'Fauna suecica,' p. 234, 1761.)

Male Imago (Pl. II, fig. 1).—*Size* small; general *colour* rather dark sienna-brown, head darker, legs paler; somewhat pubescent. *Antennæ* (fig. 5, *a*) of 12 segments, two at the base paler, and two or three

at the tip quite pale; hind margin of *pronotum* rounded; part of *wings* exposed behind elytra rather large; *second tarsal segment* of legs small and cylindrical. A long spine on the ventral side of the penultimate segment of the *abdomen*, between the callipers, which might be taken for the pygidium (fig. 4). *Callipers* (fig. 2, no. 4) somewhat remote at the base, incurved at the apex, serrated on the inner margin. *Length* up to 9 mm.; length of callipers about 2·25 mm.

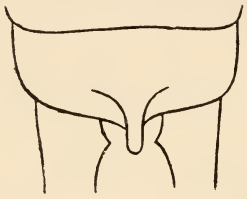


Fig. 4.—*Labia minor* Linnæus, ♂; ventral view of the extremity of the abdomen (much magnified).

Female Imago.—Similar to the male; but the *callipers* are contiguous at the base and practically so in their whole length. *Length* about 8 mm.; length of callipers about 1 mm.

Variation.—Except in size, I have found but slight variation in this little earwig. It should be borne in mind, when calculating the length of this and other earwigs, that the abdomen often contracts very much in drying. Preserved specimens are therefore usually shorter than they were in life. To prevent this contraction earwigs may be carded as soon as killed.

Date.—1 April appears to be the earliest date of which I have a note, while the latest is 1 November, the former record being due to E. J. B. Sopp, the latter to R. S. Bagnall. Probably, however, the species spends the winter in the perfect state; indeed if imagines are to be found immediately before the winter season and again just after it closes, this must almost necessarily be the case. Apparently other British earwigs act in a similar way.

Habits.—One of the most striking points in connection with *Labia minor* is the readiness with which it takes to the wing. In consequence of this it is possible to watch the insect folding and unfolding its wings—a difficult matter in species, which, unlike *L. minor*, seldom take to flight, at any rate in daylight. On 27 April 1897 I captured a male on the wing in Kingston-on-Thames. The day was very hot and sultry, and a thunderstorm occurred about a couple of hours after the capture. As it flew the earwig looked small, and its wings appeared whitish in colour. Confined in a small collecting-tube, it appeared to use its callipers to unfold its wings. F. Walker states* that "sometimes when it opens its elytra and prepares to fly, its wings do not readily unfold, and it immediately recurves its abdomen and applies its forceps to them, and then they expand at once as if a spring was loosened. The use of the forceps in folding up the wings was suggested in print many years ago." Staveley in 'British Insects' mentions that a correspondent of the 'Zoologist' described *L. minor*, when about to take flight, as turning up its tail and inserting a point of the callipers under first one wing-case and then the other, by this means quickly unfolding the wings. Further, at the meeting of the Entomological Society of London, on 2 Oct. 1865, Weir mentioned that he had observed an example of *L. minor* use its anal callipers to unfold its wings. Finally M. Burr told me† that a specimen once alighted on the hand of I. Jones of Garth, when he noticed that the callipers were distinctly used to unfold the wings: he did not notice whether they were used to fold them up.

On the other hand H. Moore, speaking of the opening and closing of the wings in this insect, says: "I watched the operation one evening not once but many times. The wings were shot out rapidly with a jerk. Then as soon as the creature landed on the bottom or

* 'Entomologist,' 1869, p. 356.
† *In litt.* 14 Nov. 1904.

side of the box in which it was confined, they remained a short time their full length over the back of the abdomen, and, while I was watching for the forceps to come into use they were quickly drawn up under the elytra. Further observation revealed the *modus operandi*. The forceps were not used at all, but the femora of the mid-legs were raised so that the knees touched the hinge-joints of the costal nervures, this allowing them to bend, the wings folding automatically as they were drawn over the back and under the elytra. The wings were not seized by the forceps and by them tucked away; the insect can and does secure its wings properly without their aid. After watching for a long time I most positively affirm that in no instance were the forceps used. Indeed, if, as Wood says, the primary use of the forceps is to pack the wings under the elytra, what, one may ask, can be their purpose amongst the apterous species?" As to this Burr says that about half the known species of earwigs are incapable of flight.* Here the matter must be left at present.

On 14 July 1907 I caught a female on my umbrella, and the pale segments at the tip of the antennæ were very noticeable when the insect moved.

L. minor sometimes swarms in the sunshine over old dung-heaps and so forth. It may also be taken in market-gardens, where there is a range of forcing-lights over manure: it may then be found crawling under the glass. R. McLachlan once stated† that on passing a stable, with dung-hill, etc., at the exit of the railway-station at Lewisham, one of the sultry afternoons in the last week of September 1903, he saw quite a swarm of flying insects, which he took to be winged ants; but, on catching one in his hat, he found them to be *Labia minor*. It is usually common enough, he says, about roadside dung-heaps around London in the summer and ordinarily lasts only a short time on the wing; but never before had he seen it so late.

* *In litt.* 14 Nov. 1904.
† 'Ent. Mo. Mag.' 1903, p. 285.

R. S. Bagnall states* that "on Nov. 1, whilst examining a manure-heap in Aswell Park for coleoptera, Professor Beare and myself turned it up in large numbers. I was struck with the peculiar superficial resemblance of *L. minor* to a rather common beetle, *Lithocharis ochracea* Gr., found with the earwig." It is stated that *L. minor* is frequently attracted to light.

Writing on 11 March 1916, O. Whittaker told me that when in camp with his regiment at Exning in Suffolk, not far from Newmarket, *L. minor* occurred very commonly during October and the end of September 1915, the ground outside his tent often revealing the presence of at least three per square foot. He took two dozen in a couple of minutes one evening as he sat at tea and still there were more. Writing again on 19 May 1916, he said that two days before he was at Bury St. Edmunds and at 5.30 p.m. there were dozens upon dozens of *L. minor* on the wing. About half-way back to Newmarket the Red Cross car broke down, and he had to wait for an hour by the road-side until another car came. It was a beautiful evening, and still more *L. minor* were to be seen. Had he had collecting materials he could have obtained a hundred or two without wasting much time. Previous to these two occasions Whittaker had taken only a couple of single examples. My own captures have been single ones also, and probably not a dozen in all.

Distribution.—*L. minor* is a native of the Palæarctic Region, and is common throughout Europe. It has been introduced into North America, and is now firmly established there. In Africa it is to be found in Cape Colony, as well as from Somaliland to the Congo.

British Localities.

England.—*Berks:* Aldworth (*Tomlin*); Reading, July 1911, common in garden (*Tomlin*); Tubney (*Holland*). *Berwick-*

* 'Ent. Record,' vol. xx, 1908, p. 305.

on-Tweed: (*Babbington, fide Stephens*). *Cambs:* Wicken (*Chitty*); Cambridge (Camb. Univ. Museum); around Cambridge, very common in 1908 (*Edwards*). *Cheshire:* Acton Bridge (*Tomlin*). *Cumberland:* fairly general (*Day*); Salkeld (*Day*); garden in Carlisle (*Day*). *Derbyshire:* Burton, etc. (*Brown*); Little Eaton (*Pullen*). *Devon:* Lynmouth (*Briggs*); Plymouth (*Bracken*). *Durham:* Hartlepool (*Gardner*). *Essex:* Epping Forest (*Campion*); Walthamstow (*Campion*); North Woolwich (*Main*). *Hants:* Brockenhurst (*Lucas*); near Winlaton (*Bagnall*). *I. of Wight:* Newport (*Morey*). *Herefordshire:* West Malvern (*Tomlin*); Ledbury (*Tomlin*); Stoke Edith (*Tomlin*); Eastnor (*Whittaker*). *Herts:* Tring (*Donisthorpe*). *Kent:* Rusthall Common, Tunbridge Wells (*Sopp*); Broadstairs (*Sopp*); Lewisham (*McLachlan*); Sheerness (*Chitty*); Faversham District (*Chitty*); Walmer (*Sauzé*). *Lancashire:* Grange-over-sands (*Sopp*); Poolmouth, Sankey (*Dunlop*). *Lincolnshire:* Alford (*Porritt*); Chauntry (*Mason*). *Middx.:* Chiswick (*Bell-Marley*); S. Kensington (*Donisthorpe*). *Monmouth:* Tintern (Camb. Univ. Museum). *Norfolk:* (*Edwards*). *Notts:* Nottingham District (*Shaw*); Sturton-le-Steeple (*Shaw*); South Leverton (*Thornley*). *Rutland:* (*fide* 'Victoria History' of the County). *Somerset:* Combre Florey near Taunton (*Jones*). *Staffordshire:* (fide *Jourdain*). *Suffolk:* Fakenham (*Shaw*); Bentley (*Morley*); Claydon Bridge (*Morley*); Yarmouth (*Paget*); Walton (*Morley*); Wickham Market (*Morley*); Glemsford (*Tomlin*); Framlingham (*Morley*); Tuddenham Fen (*Morley*); Exning (*Whittaker*); Bury St. Edmunds (*Whittaker*); Blackenham, in flood refuse (*Morley*). *Surrey:* Headley Lane (*Chitty*); Leatherhead (*Briggs*); Kew Gardens (*Nicholson*); Kingston-on-Thames and Surbiton (*Lucas*); Dormans (*Burr*); Reigate (*Saunders*); Dorking (*Guermonprez*); Southwark Street, Blackfriars Bridge (*Dyke*); Oxshott (*Ashby*); Witley (*Dalgleish*); Wandsworth (*Shaw*); Farnham District (*Sopp*). *Sussex:* Bognor (*Guermonprez*); Hastings District (*Bloomfield*); Lewes (*Chitty*); East Cliff, Brighton (*Morley*); Eastbourne (*Sopp*); Polegate (*Morley*). *Warwickshire:* Offchurch Bury, Leamington (*Chitty*). *Yorkshire:* Huddersfield (*Porritt*); Brough (*Porritt*); Heckmondwyke (*Morley*); Ferriby (Camb. Univ. Museum).

Isle of Man: Port Erin (*Cassal*).

Wales.—*South* (*Chitty*); *North*, 16 labelled "Snowdon" in the Hope Collection at Oxford (*teste Burr*).

Scotland.—*Dumfriesshire:* in flood refuse in Ellangowan District (*McGowan*). *Edinburghshire:* Comiston, Morningside, Craigentinny (*Evans*). *Fifeshire:* common at Pettycur, flying

in sunshine, July 1901 (*Evans*). *Forfarshire:* 1813 (*Don*). *Haddingtonshire:* at foot of Lammermuirs (*Evans*).

IRELAND.—*Armagh:* (*Johnson*); Belfast district (*Buckle*). *Cork:* Roscarberry (*Cuthbert*). *Donegal:* Foyle district (*Buckle*). *Dublin:* Santry (*Halbert*). *Kerry:* Carage Lake (*Donisthorpe*). *Kilkenny:* Thomastown (*Nalbert*). *Wexford:* (*Halbert*). *Wicklow:* Bray (*Cuthbert*).

Genus 4. **PROLABIA** Burr.

Prolabia BURR Deutsche Ent. Nat. Bibl. vol. ii, p. 60 . . . 1911.

Description.—In general this genus agrees with *Labia*, but it was established by Burr for those species with the segments of the antennæ beyond the third all short, and generally more or less conical or pyriform. The type of the genus is the insect before us, *P. arachidis* Yersin.

1. **Prolabia arachidis** Yers.

(Plate II, fig. 3, and Pl. V, fig. 4.)

arachidis	YERSIN Ann. Soc. Ent. France, vol. 8, p. 509, pl. 10, figs. 33–35 . .	1859—*Forficula.*
,,	FINOT Faune de la Fr. Orth. p. 70 .	1889—*Chelidura.*
,,	BURR Brit. Orth. p. 17, pl. 1, fig. 8 .	1897—*Apterygida.*
,,	WALKER Ent. Mo. Mag. pp. 132, 280	1897—*Apterygida.*
Arachidis	KIRBY Syn. Cat. Orth. i, p. 44 . .	1904—*Apterygida.*
arachidis	BURR Syn. Orth. W. Eur. p. 8 . .	1910—*Apterygida.*
,,	BURR Syn. Orth. W. Eur. p. 151 (addenda)	1910—*Labia.*
,,	BURR Fauna Brit. India, Derm. p. 123, fig. 82	1910—*Labia.*
,,	BURR Gen. Ins., Fasc. 122, p. 57 .	1911—*Prolabia.*
nigripennis	MOTSCH. Boll. Soc. Nat. Moscou, vol. 36, pl. 1	1863—*Forficula.*
wallacei	DOHRN Stett. Ent. Zeit. vol. 25, p. 427	1864—*Labia.*
gravidula	GERST. Arch. f. Naturg. vol. 35, p. 221	1869—*Apterygida.*

ORIGINAL DESCRIPTION.

Couleur de poix. Tête noire, antennes de 12 à 14 articles, fauves à la base. Pronotum bordé de fauve; elytres noires, quelquefois bordées de fauve postérieurement. Pattes ferrugineuses ou testacées; base des cuisses ordinairement tachée de noir; abdomen lisse, glabre, plis des 2e et 3e segments distincts, dernier segment du mâle quadrangulaire, avec une fossette au milieu près du bord postérieur; 8e segment ventral du mâle demi-circulaire, échancré peu profondément au sommet. Lame anale du mâle saillante à la base interne de la pince, demi-polygonale.

Pince du mâle petite, arquée, ferrugineuse, quelquefois noire au milieu, grossièrement ponctuée, avec une dent interne au deux tiers, à partir de la base. Dernier segment dorsal de la femelle comme celui du mâle; 6e segment ventral de la femelle demi-circulaire, non échancré, lame anale étroite, visible en dessous à la base interne de la pince; celle-ci courte, un peu arquée vers son sommet, branches un peu entrecroisées.—Long. du ♂ et de la ♀, 8 mill.; pince du ♂ 2 à 2½ mill.; de la ♀, 1¾ mill.—Marseille. (M. A. Yersin, "Note sur quelques orthoptères nouveaux ou peu connus d'Europe," 'Annales de la Soc. Ent. de France,' 28 Déc. 1859, p. 509, Pl. 10, figs. 33–35.)

Male Imago (Pl. V, fig. 4).—*Colour* chestnut-brown, head darker, legs paler; practically hairless. *Length* 8 mm.; length of callipers 2–2·5 mm. *Antennæ* (fig. 5, *b*) of 12–13 segments, paler at the base. *Pronotum* squarish, with straight hind-margin; lateral margins rather paler. *Elytra* free. *Wings* absent. *Scent-folds* rather distinct, on 3rd and 4th segments of

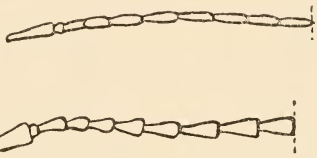


Fig. 5.—Basal segments of antenna of *Labia* Leach (*a*) and *Prolabia* Burr (*b*). (Much magnified.)

the abdomen; anal dorsal segment with a central, posterior depression, and no tubercles. *Callipers* rather small and somewhat slender, curving gradually inwards, with a tooth on the internal margin about one-third of the length of the callipers from the apex, and a second indistinct one at the base (fig. 2, no. 8).

Female Imago.—Much as the male. *Length* 8 mm.; length of callipers 1·75 mm. *Callipers* short, straight except near the tip, where they curve inwards a little, and tend to cross.

Nymph.—In the nymph the callipers are slender, and curved somewhat as in the male. At the base of the femora there is a broad dark band. In some cases at any rate there is a broad pale hind-margin to the pronotum.

Variation and Aberration.—Colouring varies in

depth. The callipers are sometimes quite dark, especially at the tip; but, what is more important, the tooth towards the tip may be very small or quite absent. The dark band at the base of the femora, which seems to be constant in the nymph, appears sometimes in the imago. *P. arachidis* is a delicate insect, which is seldom captured with its antennæ intact; the callipers too are sometimes broken.

Date.—As *P. arachidis* occurs in this country only under artificial conditions, imagines are probably always to be found, and it is quite likely that breeding is continuous. I received a number of nymphs and imagines captured on 16 Oct. 1917, at Acton Bridge: some of the nymphs were quite small.

Habits, etc.—M. Yersin, who first described *P. arachidis*, says:—"Cette Forficule a été trouvée dans le mois d'Octobre [1859] à Marseille, par M. Raymond, qui l'a prise sur les quais au milieu d'un chargement d'Arachides." In 1897 Commander J. J. Walker discovered it at the Sheppy Glue and Chemical works at Queenborough, and exhibited it at the meeting of the Entomological Society of London on 5 May 1897. In April of the next year he found them just as abundant. After a visit in August 1904 he sent me examples which were somewhat imperfect as regards antennæ, and said:—"It is almost impossible to catch the creature without breaking these organs." On 17 Sept. 1906 they were less common. In 1909 Walker found *P. arachidis* at Queenborough, not only indoors (though more frequently there), but also in the open amongst old sacks. As, however, these sacks were to some extent decomposing, there was perhaps a temperature above the normal, just as there would be in a manure-heap. At the end of March 1900 E. C. Bedwell found this earwig while searching for beetles amongst a store of bones in some soap-works at Bow. In April 1916 H. Moore received alive several examples (the majority being nymphs), taken in a City warehouse in bales of rush-baskets from Japan.

On 19 Oct. 1916, J. R. le B. Tomlin found *P. arachidis* in bone refuse at some bone-works at Acton Bridge. He again visited the works on 16 Oct. 1917, and sent me over forty specimens, most being alive when I received them. Amongst these were a considerable number of nymphs, some being quite small, as mentioned above.

In the 'Naturalist,' June 1915, p. 209, H. H. Corbett makes the following interesting record. On May 8 he was asked to visit a tannery in Doncaster, in order to examine some damaged hides from India. The hides had evidently got damp during transshipment, and fermentation had taken place. Those which he saw were stained almost black in parts, and there were many cracks and holes in them. On and about them were numerous insects, some dead and crushed, many alive and active. One bale had not been opened, but on thrusting his hand into it, it was found to be very warm inside. Two days later he again visited the place while the bale was being opened. As the heated and rotten hides were lifted off, insects crawled and ran about in hundreds. He took samples of all that he could catch and amongst them was the earwig *P. arachidis*, as was almost to be expected.

Distribution.—Although *P. arachidis* breeds under artificial conditions in Europe, it is an exotic species, which has, however, become absolutely cosmopolitan, so much so that its original home is unknown. This may, however, have been tropical Asia, where it, at any rate, is well established. It has been found in addition at various ports in Africa and America, in New Guinea, at Mombasa, in Australia, in islands in the Indian and Pacific Oceans, in Burmah, etc.

British Localities.

England.—*Cheshire:* 1916, Boneworks at Acton Bridge (*Tomlin*). *Kent:* 1897, Chemical Works at Queenborough (*Walker*). *Middlesex:* 1900, soap-works, Bow (*Bedwell*);

1916, warehouse in the City (*Moore*). *Yorkshire:* 1915, Tannery at Doncaster (*Corbett*).

Genus 5. **FORFICULA** Linn.

Forficula Linn. Syst. Nat. (ed. 10), vol. i, p. 423 . . . . 1758.

Description.—Linnæus describes the genus: "*Antennæ* setaceæ. *Elytra* dimidiata. *Alæ* tectæ. *Cauda* forcipata." He gives two species, *auricularia* and *minor;* and in a foot-note he adds: "Forficulæ *Larvæ agiles cursitantes sunt.*" At present this genus alone contains some 40 species, of which *Forficula auricularia* Linn. is the type.

In *Forficula* the antennæ have 10–15 segments, all being quite cylindrical or almost so; pronotum more or less rectangular; elytra well developed, smooth, and keelless; wings sometimes prominent, at others abbreviated or absent; legs rather slender; abdomen somewhat flattened, broadest near the middle, then narrowing to the apex—slightly in the male, more decidedly in the female; lateral scent-folds distinct; pygidium of male small and globose or produced and prominent; callipers of the male flattened towards the base and there armed with teeth, then more slender and incurved; callipers of the female in contact, simple and straight.

1. **Forficula auricularia** Linn.

(Plate II, figs. 6, 7.)

auricularia	Linn. Syst. Nat. ed. x, vol. i, p. 423 .	1758—*Forficula.*
„	Linn. Faun. Suec. p. 234 . . .	1761—*Forficula.*
„	Steph. Ill. Brit. Ent. vol. vi, p. 4, pl. xxviii, f. 1	1835—*Forficula.*
neglecta	Marsham Ent. Brit. vol. ii, p. 529 .	1802—*Forficula.*
media	Marsham Ent. Brit. vol. ii, p. 530 .	1802—*Forficula.*
borealis	Steph. Ill. Brit. Ent. vol. vi, p. 5, pl. xxviii, f. 3	1835—*Forficula.*
forcipata	Steph. Ill. Brit. Ent. vol. vi, p. 6. pl. xxviii, f. 4	1835—*Forficula.*
auricularia	Brunner Prod. Eur. Orth. p. 12 .	1882—*Forficula.*

auricularia Finot Faune de la France, Orth. p. 66, ff. 32–34 . . . . . 1889—*Forficula.*
„ Shaw Ent. Mo. Mag. p. 355 . . 1889—*Forficula.*
„ Burr Brit. Orth. p. 15, pl. i, f. 5 . 1897—*Forficula.*
Auricularia Kirby Syn. Cat. Orth. i, p. 49 . . 1904—*Forficula.*
auricularia Burr Syn. Orth. W. Eur. p. 6 . . 1910—*Forficula.*
„ Burr Gen. Ins., Fasc. 122, p. 81 . . 1911—*Forficula.*
„ Lucas Proc. S. Lond. Ent. Soc. p. 24, pls. iv ff. 6 and 7 and v ff. 1 and 2 . 1912—*Forficula.*
„ Brindley Proc. Camb. Philos. Soc. 1912–1918—*Forficula.*
„ Chapman Ent. Rec. Jan. . . . 1917—*Forficula.*

(Other synonyms are *F. major* De Geer, *F. dentata* Fabr., *F. parallela* Fabr., *F. infumata* Megerle, *F. cyclolabia* Schm., *F. macrolabia* Schm., and *F. lurida* Fisch. *F. neglecta* Marsham is an ordinary female; *F. media* Marsham is *F. auricularia* with rather longer callipers than those of the usual form; *F. borealis* Steph. has still longer callipers; *F. forcipata* Steph. has very long callipers.)

Original Description.

auricularia 1. F. elytris apice albis. *Fn. svec.* 599.
Habitat in Europa.
(C. Linnæus, 'Systema naturæ.,' Tom. i, 1758, p. 423.)

860. FORFICULA *auricularia* elytris apice albis. Fn. 599.
Suecis Twestiert, Oernmask.
Habitat in terra prægnanti.
Descr. Insectum oblongum. *Antennæ* setaceæ, longæ, tredecim vel quatuordecim articulis. *Clypeus Thoracis* planus; antice truncatus, pone rotundatus, pallidus, in medio niger. *Elytra* pallide rufa. *Alæ* extra elytra prominulæ, apice extrorsum alba; ovata macula. *Abdomen* rufescens, nudum. *Cauda* duobus unguibus arcuatis, apice conniventibus, corneis forcipata.
(C. Linnæus, 'Fauna Suecica,' p. 234, 1761.)

Male Imago (Pl. II, fig. 6).—General *colour* dark chestnut, *legs* paler. *Length* 14–21 mm., or more; length of callipers 3–9 mm., or more. *Antennæ* of 14 segments, the basal ones being rather paler; *eyes* black. *Pronotum* dark, with paler margins. *Elytra* pale, with straight hind-margin. *Wings* (fig. 6) ample, hyaline. *Scent-folds* present on third and fourth segments of abdomen; *anal segment* with four posterior tubercles. *Callipers** (fig. 2, no. 1) reddish, darker at the tip; in the typical form flattened and irregularly toothed on the inner margin at the base; one large tooth where the branches commence to curve; these are then more slender and curved almost in a circle (fig. 8).

* Some country people in Scotland call the earwig the "Horned Gollich."

Female Imago.—Similar to the male; but the anal tubercles are not so pronounced, and the callipers are simple, almost in contact, and nearly straight except

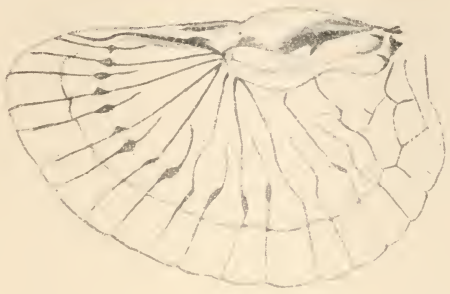
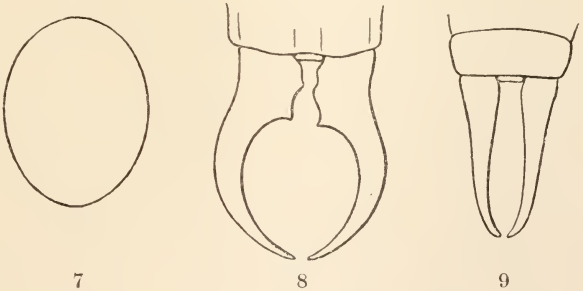


Fig. 6.—Wing of *Forficula auricularia* Linnæus (× 8).

at the tip (fig. 9). *Length* 14–19 mm.; length of callipers 2·5–3·5 mm.*

Eggs (fig. 7).—Slightly oval, but nearly elliptical; pale yellowish; smooth and shining with a pearly lustre; longest axis about 1·25 mm., shortest about 1 mm.



7 8 9

Fig. 7.—Egg of *Forficula auricularia* Linnæus (× 16).
Fig. 8.—*Forficula auricularia* Linnæus. Apex of abdomen of male (× 8).
Fig. 9.—*Forficula auricularia* Linnæus. Apex of abdomen of female (× 8).

This measurement and description were made from eggs found in a garden in Southport by O. Whittaker. Not many eggs appear to be laid, and perhaps a batch for this species would usually contain about 25. There

* For papers on the Proportion of the Sexes by H. H. Brindley see 'Proc. Camb. Philos. Soc.' 1912 and 1914. At present few definite conclusions can be drawn from the many observations made.

seem to be no records of eggs being found except in winter and spring, and pairing probably takes place in late autumn or early winter. I have myself found eggs as early as Jan. 28, on which date in 1906 I discovered beneath some Scotch firs on Esher Common, Surrey, about two or three inches under ground, a female of this species, with her eggs, near the rhizome of a bracken-fern. They were placed in a glass-topped box with a little moss and soil. Later, the mother was seen carefully hunting over the soil, and, on finding an egg, picking it up and carrying it away in her jaws to the shelter of the moss out of sight. On Jan. 31 there was a little heap of 16 eggs. Though they are fairly large, this seems a small number; but perhaps some were lost when I inadvertently brought them to light in the woods. On Feb. 2, and on the morning of Feb. 3, the mother was apparently "brooding over her eggs," but after that they seemed to be scattered and neglected. On Feb. 7 they were in the same state, and, on examination with a lens I found several, at least, bent in on one side. I concluded that they were dead, and that the mother knew the fact.

This date (Jan. 28) seems early for eggs, at any rate in England; and indeed on April 25 of the same year, in the New Forest, I found, in a piece of a decaying branch on the ground, two females together with some eggs and some very young nymphs.

On 15 March, 1914, eggs were found in stumps from which Scotch firs had been cut down on Esher Common. A batch was brought home as well as a female imago (with one branch of the callipers broken) found at the same time. In captivity she did not seem to take any notice of the eggs. Perhaps they were dead, or, just possibly, they may not have belonged to her.

In the usual way the eggs are laid in a little covered-in excavation about an inch below the surface of the ground or else in "convenient crevices of vegetation." The eggs are collected together by the fore

legs. Shortly before rupture of the egg-membrane the position of the head is easily seen by the black eyes. The young appears to bite through the membrane and comes out head first, aiding its emergence with the first pair of legs. As more of the body is freed the other legs in succession push away the egg-membrane, which is not always easily discarded. The newly hatched nymphs are about 4 mm. long. They are active and begin feeding in a few hours, or even less, after leaving the egg-membrane. (H. H. Brindley, 'Proc. Camb. Philos. Soc.' Feb. 1914.)

Nymph.—Although the nymph in general appearance resembles rather closely a small imago, closer examination reveals: a more livid colouring; the absence of wings; and simple callipers somewhat resembling those of the female, but more slender and proportionately longer. The chitinous envelope must be more delicate, for carded specimens, especially the younger ones, collapse entirely as they dry.

On 2 April 1896 in a rotten tree stump on Esher Common I came across a female with some eggs. The earwig, a few of the eggs, and some of the rotten wood, were placed in a small glass-topped box. As mentioned in the case above, the earwig carefully collected the eggs and placed them in a heap under the wood. If they were moved, or by the movement of the box were brought into the light, she carried them under cover, carefully lifting them with her jaws. So far the remarks of De Geer, in his account of the maternal solicitude of the earwig for eggs and young, were confirmed (see below); but after the young appeared, which took place in two or three days, she did not appear to me to pay much attention to them, though certainly I did not observe them very frequently. Soon after hatching they were colourless and almost transparent, their heads being large, and their antennæ and callipers of inordinate length: the wings and elytra were of course quite wanting. The young soon became darker. Changes of skin occurred, but I

cannot say how many, and by the end of July the single survivor, a female, was mature. She was small, probably through being brought up under unnatural conditions, and maybe being short of food. They were usually fed on fruit, whereas their proper food is probably not vegetable but animal. They ate greedily of banana, on one occasion, antennæ and palpi moving incessantly the while.

On 20 April 1914 Dr. T. A. Chapman gave me a living nymph of *F. auricularia* with the following history :—" Early in January I brought into the house a plant in a pot that had up till then been out-of-doors. One day early in February I found on a leaf of the plant a young earwig. I expected others to show themselves, but none did. It was so small that I was rather surprised it was out of the 'nest.' I have since kept it and fed it. It has moulted three times when it ate the cast skins, and has regenerated two joints that were missing from an antenna. How did it happen that there was a solitary earwig at such a date ? It must have been still younger when brought in, as it was several weeks later when I found it." I saw no evidence of its moulting again till 10 May, when some time that day (after the morning) it cast its skin, which it did not eat, and about 6 p.m. was pure pellucid white except the eyes which were black. It was then a small mature male. It had eaten very little, I fancy, since I received it ; probably I did not give it food to its liking.

On one occasion there was beaten from a tree on Esher Common, about 10.30 a.m., a male which had apparently just cast its last nymph-skin. It was of a uniform pale creamy-white tint, except the eyes, which were black, and a little dark cloudiness in the lower part of the abdomen, due apparently to the contents. It had practically assumed its correct colours by evening. This was on the 26th of September (1900), which seems a late date for the nymph.

In the course of experiments in breeding *F. auricu-*

laria, Dr. T. A. Chapman found that the nymph passed through six moults, and therefore that there were seven instars (not including the egg-stage), the imago being the seventh. In the 1st instar the antennæ had 8 segments, in the 2nd and 3rd 10, in the 4th and 5th 11, in the 6th 12, and in the 7th (imaginal) 14. In two cases at the 3rd instar the mother was dead or eaten, either having been killed by her offspring or having died of old age.

Variation and Aberration.—*F. auricularia* may be said, for an earwig, to show much variation, and this takes place mainly along three lines : 1, colour ; 2, magnitude; 3, shape and relative size of the callipers. The colour may be so much darker than the normal as to appear almost black, the legs also partaking in the deeper tint. The difference in size is often very striking even when there is no variation from the usual form. For example Col. J. W. Yerbury gave me a male of the typical form taken at Spey Bridge on 31 July 1911, whose total length was 20·5 mm., 5·5 mm. being due to the callipers. On the other hand I have a male from near Oxford whose total length does not reach 12 mm.

Usually, however, the large males have highly developed and lengthened callipers. As mentioned already, the names *media*, *borealis*, and *forcipata* were given to these forms when they were thought to be distinct species. It is necessary, however, to retain *forcipata* only, which belongs to the extreme and fairly constant form (fig. 2, no. 2), for intermediates do not seem to occur at all frequently. Some of these examples of var. *forcipata* are indeed fine insects. One was taken on 26 July 1910 by Percy M. Bright on the cliffs at Freshwater in the Isle of Wight, whose length from mouth to tip of callipers was 25 mm., the callipers themselves measuring 10 mm.*

* It was evident on examination that the insect was damaged. When etherised two dipterous larvæ, each measuring 6·25 mm. in length, belonging to the Muscidæ, emerged from it.

This, however, was eclipsed by a male taken by H. H. Brindley in the uninhabited islet of Rosevear in the Scillies. The callipers alone in this case measured 12·25 mm., while the total length of the insect (which is damaged) appears to be about 32 mm. Burr notices an individual with very small callipers—a rare aberration.

On the visible wing-tip there is often a pale spot, which becomes a very conspicuous adornment of a form from Macedonia, var. *conspicua* Luc.

In the summer of 1903 Burr took at Compton Bay in the Isle of Wight two wingless female earwigs amongst typical *F. auricularia*. This is most interesting since the females of this species can scarcely be distinguished from the females of *F. decipiens* Géné, and *F. silana* Costa, except for the absence of the wings in the last two species. Have we here a wingless form (apparently unknown previously) of *F. auricularia* ♀, or a species new to Britain? The latter could be proved only by the discovery of the males.*

Not infrequently aberrant forms come to hand, chiefly in connection with the callipers: a few of these must be referred to. In April 1898 I took in a garden at Oxford a female with the left branch of the callipers much shorter than the right and twisted (fig. 3, no. 1). Amongst a number of examples found in a garden in the town of Warwick, September 1905, was a male with very abnormal callipers (fig. 3, no. 2). They were long and slender, but the chief peculiarity was that they were soldered together at the base, while the distal part seemed to be jointed to the basal. If this is the meaning of the peculiarity, it is of interest in connection with the fact that the cerci of other Orthoptera are regularly jointed. Also in September 1905 R. A. R. Priske took a male (fig. 3, no. 4) at Deal, in which the left branch of the callipers was normal, but the right was large as in var. *forcipata*, but more

* Vide 'Ent. Mo. Mag.' (2), vol. xxii, p. 226, fig. 7.

strongly curved. In a garden at Teddington, Middlesex, I found in April 1908 a male (fig. 3, no. 3) with the left branch of the callipers simple and the right normal of the small rounded type. C. A. Briggs possessed a similar one. In August 1903 H. Donisthorpe took a male at Ryde in which the right branch was simple as in the female.* No doubt it would be quite easy to multiply instances of such aberrations.

Date.—Apparently *F. auricularia* may be found as an imago throughout the year, those surviving after the winter having passed it more or less in a state of hibernation. Many females no doubt survive, as eggs seem to occur only in winter and spring; whether males survive as frequently it would not be easy to tell. That the latter sex does hibernate is certain, for I have found them more than once under conditions such that they must have done so. On 14 January 1906 I met with one in a rotten tree-stump on Esher Common, Surrey. On 25 February 1905 I discovered more than one inside dead and hollow stems of deadly nightshade (*Atropa belladonna* Linn.) on Ermyn Street, near Leatherhead, Surrey. Nymphs occur so late in the season that it seems difficult sometimes to consider them as coming from winter or spring eggs, though the insect is thought to be only single-brooded; but this and many other points in connection with even the common earwig need elucidation by entomologists, and H. H. Brindley of Cambridge is working hard to increase our knowledge of this very common insect.

Habits.—What is the natural food of *F. auricularia?* This is an important point; for whether it is to be looked upon as friend or foe depends upon the answer which is to be given to this question. That it often hides amongst the petals of some flowers is common knowledge, and that it damages them is equally certain. This may be due to the nectar at their base being

* Brindley ('Ent. Mo. Mag.' Mar. 1918) figures an example with one leg of the callipers branched.

attractive to the earwigs, for they have a certain amount of liking for ripe fruit.

It seems to be the fact, however, that earwigs are by nature animal feeders* and that other insects form their staple food. One or two instances might be cited. In August 1909 H. Eltringham noticed at South Shields a common earwig (he thinks a male) eating in the evening the eggs of *Tryphæna pronuba* Linn., as the moth deposited them. It ate probably about 60 by the next morning. Staveley ('British Insects') quotes a case of *F. auricularia* seizing a small beetle round its middle with the callipers and carrying it away in spite of its struggles. Camerano, Rühl, and others have noticed that the earwig is fond of a carnivorous diet. *F. auricularia* is reported to be beneficial by exterminating larvæ of *Conchilis ambiguella* Hubn.,† and its destroying the sugar-cane leaf-hopper (*Perkinsiella saccharicida*) has already been referred to. In 1829 McGorrie states that the earwig destroys the larvæ of *Cecidomyia tritici* Kirby, three of which he successively presented to an earwig which devoured them immediately.‡ J. W. Douglas states that earwigs are probably coccidiferous, as judged by two young earwigs being found engaged in demolishing the last remains of a *Lecanium ribis*.§ On the other hand F. V. Theobald on one occasion found the young of *F. auricularia*, which were very numerous, destructive to tender hop-foliage at night; he also states that this earwig "is often very abundant and destructive to flowers and vegetables."‖

In a paper "Notes on certain Parasites, food, etc.," of the common earwig, Brindley discusses fully his experiments and observations on the food of this earwig. He found it both an animal and a vegetable feeder ('Proc. Camb. Philos. Soc.' Feb. 1914). Sopp considered it "largely carnivorous by choice, but often

* Vide H. H. Brindley, 'Proc. Camb. Philos. Soc.' July 1918.
† 'Rovartani Lapok,' 1899, p. 175, and appendix, p. 16.
‡ Loudon's 'Mag. Nat. Hist.' Nov. 1829.
§ 'Ent. Mo. Mag.' 1882, p. 88.
‖ 'Ent. Mo. Mag.' 1896, p. 60.

phytophagous, frugivorous, or even necrophorous by necessity."

One point in the œconomy of *F. auricularia* is the care it bestows on eggs and young. H. Gadeau de Kerville in a paper published at Rouen in 1907 has collected some of the information on this subject, from the time of De Geer onwards. Though often quoted, it is nevertheless expedient to give a translation of De Geer's observations. He speaks substantially as follows* :—

"At the beginning of June I found under a stone a female earwig with several small insects, which were quite obviously her progeny. They did not leave her, and even placed themselves under her body as chickens under a hen. So insects of this kind take care, in a way, of their offspring after they are born, and stay near them as if wishing to protect them.

"Except in a few points the young resemble their parents. . . . I placed them with their mother in a box, wherein I had put a little fresh earth, and it was curious to see how they crept under the body and between the legs of their mother, who remained very quiet and allowed them to do so. She, as it were, covered them as a hen does her chicks, and they often remained in this position for hours together. . . . .

"Again at the beginning of April 1759 I found some female earwigs under stones, with a mass of eggs, on which the mother was seated, and of which she took the greatest care, never going a step away from them. (M. Frisch has observed this before me.) I took the mother with her eggs and placed them in a box half-filled with fresh earth, the eggs being scattered here and there; but she soon picked up the eggs, carrying them in her jaws. After a few days I saw that she had collected the eggs into one place on the surface of the earth in the box, and that she remained constantly seated upon them in such a way that she really seemed to be covering them."

* C. de Geer, 'Mémoires pour servir à l'hist. des Ins' t. iii, p. 548, 1773.

These observations are confirmed by Kirby and Spence, Taschenberg, Camerano, Ruhl, Larbalétrier, Lesne, and others including the present writer (see pp. 42–44). Dr. Chapman even suggests that the mother may collect food for her young. Bits of grass was the provender indicated, which however is not the kind of food that one would expect an earwig to choose.*

Sharp records the following case†: "On the shore at Hayling Island I lifted a small stone—some 6–9 cubic inches—rather firmly fixed in the tenacious soil a little above the tide-line, and found under it a female earwig. The creature was covering a small cavity, and this cavity was filled with numerous minute young earwigs; only one young one was at large and this was close to the mother. As the little family was evidently disturbed by the discovery I replaced the stone, and did not take possession of the mother. I feel pretty sure, however, that the species was *Forficula auricularia*, the common earwig. The psychology of such cases might give rise to interesting discussions. But at present I think all that can be considered certain is that association between mother and offspring is continued after deposition of the eggs, and is prolonged even after the hatching of the young." From what I have noticed myself I agree with Sharp that the question of "maternal solicitude" must not be pressed too far. Indeed A. O. Rowden found on 26 April 1902 at Dawlish Warren in Devon a female "with its young (which it seems to have since eaten) in a hole in the sand, just above, and very close to, high water-mark."

F. auricularia does not readily take to the wing in the ordinary way, though there may be certain atmospheric conditions which conduce to its doing so. There seem to be few actual records of flight for this species. W. E. Collinge mentions‡ their flying in at a

* 'Entomologist,' 1910, p. 292.
† 'Entomologist,' 1910, p. 250.
‡ 'Journal of Economic Biology,' vol. iii, pt. 2, 1908.

window between 9.30 and 10.30 p.m. on three warm, dark, sultry, calm nights in succession. Twenty-six entered, and all were males. He was able also to give two instances of flight in the daylight. Theobald * says the adults readily take to the wing on certain nights, especially when the moon is bright, and that numbers used later in the year to fly into his house attracted by the lights. In Aug. 1867 W. D. Douglas caught one flying at night in a garden at Lee. They often come to the entomologist's "sugar"; but it has not been noticed whether they arrive on the wing. In consequence of *F. auricularia* so seldom being seen to fly, little is known as to whether the callipers are used in opening or closing the wings. Burr, however, mentions that it has been observed in one instance.

Occasionally *F. auricularia* occurs in great numbers. Such was the case near Kingston-on-Thames in 1881. Writing on 18 March 1916, O. Whittaker sent to me from the camp at Newmarket the following note of the occurrence of this earwig in large numbers. It appears that the orderly room in which he was working consisted of a canvas tent supported by a longitudinal ridge-pole resting on three upright posts. Every day *F. auricularia* sought refuge up by the ridge-pole, where they must have been in thousands. From this elevation they used in the day-time to drop excreta. Out of curiosity he one morning placed a piece of paper on a table directly beneath the ridge-pole. It was left for an hour, and, when counted, the number of spots of excreta was found to be "three score and eleven." This experiment was performed about the end of June or beginning of July; but *F. auricularia* swarmed there all through the summer. In the morning he would find five or six in his rifle-breech and as many in the barrel. He did not take a census of males and females, though the circumstances would have afforded an excellent opportunity for doing so. One morning he killed over 100 in one tent

* 'Ent. Mo. Mag.' (2), vii, p. 60, 1896.

without making an appreciable effect on their numbers. There were about 100 tents and thousands of earwigs in each. He did not see any examples of var. *forcipata*.

Six, four males and two females, were taken from a wasps' nest at Manchester on 8 Sept. 1916 (Mrs. Cawley, 'Lanc. and Chesh. Fauna Records').

H. V. Corbett relates how on 2 Sept. 1916 a fight took place between ants (*Myrmica ruginodis* Nyl) and a male common earwig. The latter made much use of legs and callipers, but after a struggle of some two hours he was much weakened and dragged into the nest ('Naturalist,' Nov. 1916, p. 348).

Distribution.—*F. auricularia* is as common throughout Europe as it is in Britain. It occurs also in Asia Minor, North Africa, and Madeira. It has found its way to North America, and to Christchurch, New Zealand, while it is mentioned for Japan.

British Localities.

Apparently this earwig is ubiquitous throughout the British Isles, and to give all the localities that have been recorded would be useless. It will be necessary therefore to mention only outlying localities. Such are: St. Kilda and North Uist (*C. W. Dale*); south end of Mull of Cantyre (*Stewart*); Lunna in Shetland (*Peacocke*); Bass Rock and Isle of May (*Evans*); Kilantringan, Wigtonshire (*Evans*); Isle of Man (*Shaw*); Scilly Islands (*Brindley*); Lundy (*Walker*); Fair Isles, Northumberland (*Grimshaw*); Gt. Aran in Galway Bay, Tory Island, and Clare Island (*Carpenter*).*

"High males," *i. e.* var. *forcipata*, occur not uncommonly, but I have records for the following counties only: Dorset, Hants, Kent, Lancashire, Middlesex, Somerset, Suffolk, and Worcester. It is sometimes considered an island-form and there are records of it for St. Kilda and the Scilly Isles. Its distribution clearly requires much further investigation. Brindley has written on the earwigs of the Scilly Isles, where generally speaking these insects are numerous and var. *forcipata* is common. ('Proc. Camb. Phil. Soc.' Feb. 1914, etc.)

* Dr. F. A. Walker says that *F. auricularia* abounds in the Faroë Islands, but does not occur in Iceland ('Entom.' 1890, p. 378).

2. **Forficula lesnei** Finot.

(Plate II, fig. 8, and Pl. V, figs. 5 and 6.)

lesnei	FINOT Bull. Soc. Ent. Fr. vii, p. 189 . .	1887—*Forficula.*
„	FINOT Faune de la Fr. Ins. Orth. p. 68, f. 2.	1889—*Forficula.*
pubescens	SHAW Ent. Mo. Mag. p. 358 . . .	1889—*Forficula.*
„	BURR Ent. Mo. Mag. (2), vii, p. 230 . .	1896—*Forficula.*
„	BURR Brit. Orth. p. 16, pl. i, f. 6 . .	1897—*Forficula.*
lesnei	LUCAS Entom. xxxi, p. 49, pl. 1, f. 1, and Entom. xxxi, p. 273, fig. in text . .	1898—*Forficula.*
Lesnei	KIRBY Syn. Cat. Orth. i, p. 50 . . .	1904—*Forficula.*
lesnei	BURR Syn. Orth. W. Eur. p. 7 . .	1910—*Forficula.*
„	BURR Genera Insectorum, Fascicule 122, p. 82	1911—*Forficula.*
„	LUCAS Proc. S. Lond. Ent. Soc. p. 25, pl. iv, f. 8	1912—*Forficula.*

ORIGINAL DESCRIPTION.

FORFICULA LESNEI, Finot.—♂. Long. corporis: 6–10 mill.; pronoti: 1·5–1·8 mill.; elytrorum: 1·4–2 mill.; forcipis: 3 mill.— ♀. Long. corporis: 8–9 mill.; pronoti: 1·5–1·8 mill.; elytrorum: 1·8 mill.; forcipis: 1·8 mill.

Fusco-testacea. Caput concolor, parte anteriore fusca. Antennae pallidae, articulis 12 *instructae. Pronotum concolor disco fusco, quadratum margine postico rotundato. Elytra subtiliter impresso-punctata, margine postico truncato angulis rotundatis. Alae abortivae sub elytris totae absconditae. Pedes fusco-testacei. Abdomen impresso-punctatum; plicis lateralibus in segmento tertio minimis, in segmento quarto parvis. Segmentum anale postice subbituberculatum, latere subplicatum. Lamina subgenitalis transversa, postice rotundata.*

♂. *Crura forcipis pronoto duplo vix longiora, usque ad medium dilatata, contigua, et margine interno crenulata, ad apicem dilatationis subdentata; dehinc subteretia, semicirculariter incurva, ad apicem haud contigua. Pygidium quadratum bituberculatum.*

♀. *Crura forcipis subtriquetra, recta, apice incurva. Pygidium exiguum.*

Habitat in sepibus et herbis, tempore septembre, *prope* Saint-Arnoult *et* Benerville (Calvados).

Cette espèce, intermédiaire entre les *Forficula pubescens* Géné et *Forficula decipiens* Géné, toutes deux méridionales, a été découverte dans le Calvados, près de Trouville, en septembre, sur les branches des buissons, dans les haies et sur les herbes, par M. Pierre Lesne.

Je crois que c'est cette même espèce qui me fut signalée, il y a quelques années, du chemin de Fourqueux près Saint-Germain-en-Laye, par M. L. Brisout de Barneville, qui la rapportait avec beaucoup de doute au *Forficula pubescens* Géné.

Quoi qu'il en soit de cette localité de Saint-Germain, dont je n'ai point vu les types, le *Forficula Lesnei* diffère bien des autres *Forficula* connus, notamment par la forme des branches de la pince des ♂, ranches qui sont dilatées jusqn'au millieu de leur longueur.

Ces branches diffèrent de celles du *Forficula pubescens* Géné par l'absence de la partie subcontiguë et de l'épine interne; elles ont une grande analogie avec celles du *Forficula decipiens* Géné, abstraction faite de la longueur proportionnelle de la dilatation, qui n'est que d'un tiers dans *decipiens* et des deux tiers chez *pubescens*. Elles se distinguent cependant bien de celles de *decipiens* par le renflement qu'elles présentent à l'apex interne de la dilatation, renflement qui rappelle l'épine de *pubescens*. *Forficula Lesnei* est en outre constamment plus foncé et plus uniforme de couleur que ces deux espèces; il se distingue facilement des deux autres *Forficula* à ailes nulles, *Tomis* Kol. et *Aetolica* Brunner, dont les pinces des ♂ ont une longueur trois fois supérieure à celle du pronotum. (Finot, 'Bull. Soc. Ent. France,' (6) vii, p. clxxxix (1887).)

Male Imago (Pl. V, f. 5).—*Colour* bright sienna-brown, legs and antennæ somewhat paler, head with a ruddier tinge. *Length* 12–14·5 mm.; length of callipers 2·5–3·5 mm. *Antennæ* consisting of 12 segments. *Pronotum* squarish, with hind-margin curved. *Elytra* with margins nearly straight. *Wings* aborted. *Abdomen* with small lateral scent-folds on segments 3 and 4; on the anal segment two posterior tubercles; the subgenital lamina rounded behind. The *callipers* (fig. 2, no. 3) dilated in the basal half, contiguous and crenulated along the darker inner margin: the dilatation ending with a blunt tooth internally: thence branches more slender, and curved almost in the form of a circle: the darker tips not meeting. The *pygidium* squarish, with two tubercles.

Female Imago (Pl. V, f. 6).—Much like the male. *Length* 12–14·5 mm.; length of callipers about 2 mm. The *callipers* simple, straight and almost in contact; the tips, however, curved inwards slightly. *Pygidium* very small.

Nymph.—Since the imagines are wingless, the nymphs, except when they are quite small, closely resemble them. The callipers are rather long and very slender. It does not seem clear whether the sex of the larger nymphs may be distinguished, in this and other earwigs, by means of the callipers when they are approaching maturity: in general they appear to resemble those organs in the female, which may be the more primitive form.

Variation and Aberration.—There is but slight variation in size or colour. W. J. Ashdown notes that the tips of the callipers of the male do not always gape, but are sometimes in contact, and that occasionally those organs are more elongate than usual. W. West gave me a male, taken at Boxhill on 1 September 1898, in which the usually curved part of the left branch of the callipers is nearly straight (fig. 3, no. 5).

Date.—In England *F. lesnei* is mature at the end of the summer and in the autumn, some even being in the nymphal stage in September. Ashdown says that he takes only females in the spring. He therefore concludes that they alone hibernate; but perhaps both sexes may do so, for Com^r. J. J. Walker took a male in moss at Streatley in Berks on 21 October 1905, and another male in a tuft of grass at Headington Wick near Oxford on 24 November 1906.

Habits.—In his 'British Orthoptera,' 1897, Burr figured a *Forficula pubescens* Géné, which he took in Sept. 1896 at the Warren, Folkestone. After examining the figure de Bormans suggested that the insect was really *F. lesnei* Finot. On Burr's examining the insect further and comparing it with Finot's figures and description, there was no doubt that the Folkestone earwig was a true *F. lesnei*. In October 1897 W. West took a male by sweeping on the chalk in the neighbourhood of Reigate in Surrey at a spot where *Ononis* was growing in plenty. During 1898, while searching more especially for Hemiptera, West was on the alert for *F. lesnei* and his efforts were crowned with unexpected success. On 1 September, while beating birch near Leatherhead, he took two males. On the 3rd of the same month, at Reigate, using the sweeping-net from 10 a.m. till 3 p.m. for Hemiptera, he swept every patch of *Ononis* he could find, and not an earwig came to the net; but, when beating whitethorn, hazel, etc., *F. lesnei* was taken quite commonly. Clearly there was no special connection between the

earwig and the restharrow (*Ononis*). The same season Ashdown found this earwig in many places around Leatherhead during September and October, and in some places it seemed to replace *F. auricularia*. He took it in the sweeping-net and by beating old hedges.

Early in October 1899, with Ashdown, I visited two of the haunts of *F. lesnei* near Leatherhead. Beating bushes in the hedgerows produced it in considerable numbers; in fact it was obtained much more commonly than its congener *F. auricularia*, as many as three or four being more than once found in the umbrella at the same time. It is readily distinguished at sight from the commoner species by its much smaller size, its rich sienna-red colouring, and in the male by the shape and colour of the callipers, which look conspicuously pale. Of course, closer examination reveals the fact that there are no wings in either sex. Males occurred rather more commonly than females. Notice was taken of the plants of which the hedges consisted, from which *F. lesnei* was beaten. The following were amongst them:—Bramble, hazel, wayfaring-tree, dogwood, blackthorn, whitethorn, elder, rose, ivy, oak, maple, and spindle-tree. The list is long enough, but probably no significance is to be attached to it, as no doubt the earwigs used the bushes for shelter, or were seeking their food upon them. *F. lesnei* will eat fruit, and Ashdown fed some on rice; but if the truth were known, it would probably turn out that they are omnivorous, even if they are not more often insectivorous, seeking their food on the plants from which they are swept or beaten. It may be mentioned that Burr obtained this earwig amongst thistles and nettles in the Isle of Wight, while Tomlin took it on yellow horned poppy at Swanage. Burr found it more frequently in the evening than in the daytime on 8 September 1907 by sweeping amongst flowers and shrubs at Folkestone Warren, while Porritt (13 September 1913) got it there plentifully by beating

low plants. A few also occurred to him on "sugared" posts in the evenings. In speaking of his records of *F. pubescens* (= *F. lesnei*) C. W. Dale says it occurs chiefly amongst reeds on the south coast.*

Distribution.—This earwig has a very limited distribution. It occurs in France, Southern England, Northern Spain, and perhaps Portugal—nowhere else so far as is known at present. It was first described as a distinct species from specimens captured near Bénerville (Calvados) by P. Lesne in 1887.

British Localities.

F. lesnei has now been taken in quite a number of English localities, and there is little doubt that they will be added to considerably in the future. It may be local, for it must be recollected that this earwig cannot fly and therefore the male must seek the female by aid of its legs alone; this may perhaps restrict the distribution. At present the list of localities is :

England.—*Berks :* near Wallingford, a ♂, Sept. 1892 (*Donisthorpe*) ; Bradfield College near Reading (*Chitty*) ; Streatley, a ♂, 21 Oct. 1905 (*Walker*) ; Cothill near Abingdon, singly twice, 18 and 20 Sept. 1910 (*Walker*). *Cornwall :* Falmouth (*C. W. Dale*) ; Scilly Isles, first few days of October 1890 (*C. W. Dale*). *Devon :* Sidmouth (*Bracken*). *Dorset :* common on coast (*Briggs*) ; Weymouth (*J. C. Dale*) ; Charmouth Sept. 1837 (*J. C. Dale*) ; Bournemouth (*C. W. Dale*) ; Glanvilles Wootton, two (*C. W. Dale*) ; Swanage (*Tomlin*). *Essex :* Colchester, in the early part of 1898 (*Harwood*). *Hants :* Bonchurch, Isle of Wight (*J. C. Dale*) ; Freshwater, I. of Wight (*Burr*) ; Ventnor and Compton, I. of Wight (*Burr*) ; Undercliff and Blackgang, I. of Wight (*Burr*) ; Niton and S. Catherine's Point (*Donisthorpe*). *Kent :* Folkestone Warren, Sept. 1896 (*Burr*) ; Queensdown Warren near Chatham, probably 1899 (*Walker*). *Oxon :* a specimen in the Hope Museum in Oxford labelled "Kingston in hedges, 1840" (*teste Hamm*) ; Beckley, 10 Sept. 1904 (*Walker*) ; Headington Wick near Oxford, a male, 24 Nov. 1906 (*Walker*). *Surrey :* near Reigate (*West*) ; near Ranmore, 8 Oct. 1899 (*Lucas*) ; Witley two, 1909 (*Dalgleish*) ; Boxhill (*Burr*). *Sussex :* Pagham and Selsea (*Guermonprez*). *Wilts :* Wilton near Salisbury, one taken by Curtis, May 1852 (*fide C. W. Dale*).

* 'Entomologist,' 1895, p. 333.

Genus 6. **APTERYGIDA** Westwood.

Apterygida Westwood Intro. Mod. Class. Ins. vol. ii, p. 44 . 1840.

Description.—This genus resembles *Forficula* in every respect except that the callipers of the male are remote and slender and that the wings are usually abbreviated. *A. albipennis* Meg. is the type of the genus.

1. **Apterygida albipennis** Megerle.

(Plate II, fig. 5, and Pl. V, fig. 7.)

albipennis	Meg. (Apud Charp.) Hor. Ent. p. 68 .	1825—*Forficula.*
media	Hagenb. (nec Marsham) Symb. Ins. Helv. p. 16, ff. 6, 7	1822—*Forficula.*
pedestris	Borrelli (Apud Géné) Ann. Soc. Nat. Reg. Lomb. Ven. vol. ii, p. 13.	1832—*Forficula.*
albipennis	Steph. Mand. vi, p. 7, pl. 28, f. 5 .	1837—*Chelidura.*
,,	Brunner Prod. Eur. Orth. p. 21 .	1882—*Chelidura.*
,,	Shaw Ent. Mo. Mag. p. 359 . .	1889—*Chelidura.*
,,	Finot Faune de la Fr., Orth. p. 70, f. 37	1889—*Chelidura.*
,,	Burr Brit. Orth. p. 17, pl. 1, f. 7 .	1897—*Apterygida.*
Albipennis	Kirby Syn. Cat. Orth. i, p. 44 . .	1904—*Apterygida.*
media	Burr Syn. Orth. West. Eur. p. 8 .	1910—*Apterygida.*
albipennis	Burr Genera Insectorum, Fasc. 122, p. 80, pl. 7, f. 13	1911—*Apterygida.*
,,	Lucas Proc. S. Lond. Ent. Soc. p. 25, pl. 5, f. 7	1912—*Apterygida.*

Original Description.

Forficula albipennis.

(Meg. de Muchfeld.)

Hagenbach, pag. 16, fig. 7, mas. fig. 8, fœm. F. media.
Habitat circa Basileam et in aliis Europæ australis partibus.

Nomen F. albipennis a clarissimo de Muchfeld huic insecto impositum melius Hagenbachiano mihi videtur, quum F. mediam jam habeamus a cl. Marsham propositam [perperam vero hoc nomine marem Forficulæ minoris veluti speciem peculiarem signavit] et quum nomina a magnitudine data plerumque inutilia sint facileque in errores inducant.

Descriptio Hagenbachiana perbona est: icones optimæ.

Dens in latere inferiori forcipis maris in medio positus est: in F. gigantea est apici propior: in F. auricularia basi propior.

Notatu præcipue dignum est, hanc Forficulam elytris quidem, sed non alis instructam esse.

(Charpentier, 'Horæ Entomologicæ,' p. 68, 1825.)

Male Imago (Pl. V, f. 7).—*Colour* pale sienna-brown, legs, antennæ, and callipers usually paler, pubescent. *Size* rather less than typical *F. auricularia*. *Length* 13–16 mm., length of callipers 3–4·5 mm. *Antennæ* of 12 segments. *Pronotum* with hind margin rounded. *Elytra* free, hind margin straight. *Wings* absent. *Abdomen* covered with fine hairs; with bright dark scent-folds on segments 3 and 4; a tubercle on each side of the anal segment; pygidium squarish, notched behind. *Callipers* (fig. 2, no. 7) slender, hairy, only slightly incurved, undilated, bearing one tooth at about the middle of each branch of the callipers on the inner side, and a blunt one at the base; tips not contiguous.

Female Imago.—Much as the male, except that the anal segment is narrow, and without tubercles, while the callipers are nearly straight and unarmed. *Length*, 12–14 mm., length of callipers 2·5 mm.

Variation.—In dried examples there is considerable variation in size; but probably this would be less conspicuous in the living insects. Some are much darker than usual, the deeper colour extending to antennæ, legs, and callipers (fig. 3, no. 6).

Date.—Westwood's Ashford specimens were taken in June (*fide* C. W. Dale). B. S. Harwood has taken it on 31 August and also in September. Porritt took it profusely in September 1913, while Chitty found it in evidence from the end of July till the 10th of October, 1904. Apparently, like *F. lesnei*, it is mature in its British localities in late summer and autumn. Nothing seems known about the earlier stages, at any rate in this country.

Habits.—According to C. W. Dale, Westwood's historical specimens were taken (scantily, Burr) in a nursery-garden at Ashford. A. J. Chitty found them plentifully in the autumn of 1904 in the same district in which Westwood obtained them nearly three-quarters of a century before. They occurred throughout the district in suitable localities, which

appeared to be in the valleys where the soil was light and chalky, and where there was plenty of vegetation. They were generally on the sunny side of the valley, or at any rate sun seemed necessary for them. Chitty found a few beneath bark in company with *F. auricularia;* but they were generally obtainable by sweeping herbage, especially where plants like marjoram were growing. The largest haul was from some hop-bines after the hops had been picked; but they had previously been swept from the sunny bank below the hedge of this hop-garden. Chitty found the female more abundant than the male. He thought *A. albipennis* must have been more plentiful than usual in 1904, or he would have noticed it before.

During September 1915, while "beating" for moths Harwood found this earwig in Suffolk, and in Essex across the River Stour. He considered the species not rare, since it occurred in three places, but certainly very local, as other apparently suitable spots failed to produce a specimen. It was beaten from hedges and other similar places. As mentioned in connection with *F. lesnei*, its localness may to some extent be due to its being wingless. When sending me some specimens taken in the evening of 31 August 1917 at Sudbury, Suffolk, Harwood said: "It seems not uncommon round Sudbury by beating herbage, but you soon get out of its range."

On one occasion Porritt took *A. albipennis* about Stonehall Farm in Kent by beating nettles over an umbrella. It is worth noting that Burr is able to say that some 30 years before 1908 there was a hop-garden at Stonehall. Burr also states that in France it seems to be most frequent on clematis and other shrubs, especially near streams.

Distribution.—*A. albipennis* is an insect of Central Europe—France, England, Holland, Belgium, Switzerland, Austria, Spain, and Greece at least. Norfolk appears to be the northern limit of its distribution and Granada the southern.

British Localities.

England.—*Kent:* Ashford,* June 1832 according to C. W. Dale (*Westwood*); Charing in the Pilgrim's Way, hop-garden above Hockley Hole, road between Eastling and Newnham, and an out-of-the-way part of Dodington, all in 1904 (*Chitty*); Watersend, Stonehall, Lydden, in 1908 (*Burr*); Beachborough behind Folkestone 1911 (*Burr*). *Norfolk:* a pair near Norwich, about 1889 (*Edwards*). *Suffolk:* near Sudbury, 1915 and 1917 (*Harwood*). *Essex:* near River Stour, 1915 (*Harwood*).

Casual Earwigs.

Four at least have been noticed in England:—

Anisolabis maritima Bonelli. This earwig was found by T. J. Bold near South Shields in 1856. It was taken in heaps of ballast emptied by ships returning from abroad and was evidently an importation. Presumably it has disappeared, otherwise it would rank, as a naturalised alien, with *A. annulipes* and *P. arachidis*. In general aspect it is somewhat like *A. annulipes*, but it is rather larger and dark brown in colour. It has also occurred in the Breweries at Burton, probably imported with barrel-staves (E. Brown, *fide* F. Jourdain).

Chelisoches morio Fabr. A pair came to Kew Gardens in sugar-cane from Mauritius in August 1894. They are large black insects quite distinct from any British species. (Figured in 'Entomologist,' March 1898.)

Anechura lewisi Burr. In 1904 a single specimen, a male, was taken amongst "sweepings" in St. John's Market, Liverpool. It is about as large as *F. auricularia*, and resembles it in colour; but the much bowed callipers at once distinguish it from the common British species. (Figured in 'Entomologist,' May, 1910.)

Doru lineare Eschsch. In June 1905, a single male of this Central American species was taken in Liverpool Dock. The yellow lines along elytra and wing-tips, and the long callipers with tooth near the apex, make this also a distinct species.

* In the Hope Collection at Oxford, there is one pair, old and in bad condition. No locality is attached, but the specimens are probably some of the original ones taken at Ashford by Westwood. In his handwriting they are labelled "*F. centralis*, Westw., M.S." (Burr).

Sub-order II. BLATTODEA.
(Cockroaches.)

Cockroaches or Blackbeetles! As we have so often been told, the second colloquial name of these insects is not a happy one, since they are neither black nor beetles, though to the casual observer they are sufficiently dark, and like enough to beetles, to well merit the title. The other popular name—Cockroach—seems scarcely more appropriate, since the creatures bearing it have no connection with either fowl or fish. This term seems to be derived from the Spanish word "cucaracha," but if this means "a little berry," the fitness of the name again is not very apparent. "Cucaracha," it seems, means "woodlouse" also, and a curled-up woodlouse would not be so very unlike a cockroach oötheca.

Shelford has an interesting note on this subject. He remarks that Americans have abbreviated this word to "roach," and says*:—"As 'roach' is good Anglo-Saxon for a species of fish, the use of the word for an insect is objectionable. 'Cockroach' is derived from the Spanish 'cucaracha,' a word of obscure etymology but possibly derived from some South American Indian word signifying this insect. 'Cuco' in Spanish means a sort of caterpillar or bug, and 'cucaracha' is possibly connected with this: if so the elision of the first syllable of 'Cockroach,' the syllable which originally gave the word its significance, is doubly objectionable."

Two colloquial names attached to an insect proclaim it a familiar one; and it would seem that to the cockroaches the well-known proverb may with justice be applied, which says that "familiarity breeds contempt"; though it may be that to those whose duties lie in the kitchen or the bakehouse "contempt" is far too mild a term by which to express their

* 'A Naturalist in Borneo,' p. 114.

feelings towards these venerable members of the insect tribes. The limited number of entomologists, who have given closer attention to them, look upon them, however, with quite different eyes.

We may define the BLATTODEA as :

Orthoptera with all the legs more or less alike; the large and free coxæ entirely covering the ventral surface of the thoraæ and the base of the abdomen; tarsi of five segments. Head, in repose, bent under the thoraæ, so that the fore part points backwards; antennæ long and slender (there being often nearly a hundred segments). Pronotum shield-like, frequently quite concealing the head. Wings with the anal region capable of fan-like folding (but the alar organs are variable and sometimes entirely absent). Cerci, variable in size and shape, present in both sexes; a pair of slender styles also usually present in the male.

Twelve families are comprised within the sub-order Blattodea :

W.B.*	1. ECTOBIIDÆ.		7. BLABERIDÆ.
W.B.	2. PHYLLODROMIIDÆ.	W.	8. CORYDIDÆ.
	3. NYCTIBORIDÆ.		9. OXYHALOIDÆ.
	4. EPILAMPRIDÆ.		10. PERISPHÆRIIDÆ.
W.B.	5. PERIPLANETIDÆ.		11. PANESTHIIDÆ.
W.B.	6. PANCHLORIDÆ.		12. GEOSCAPHEUSIDÆ.

Only five of these families are represented in western Europe. Of these, four contain species that are found to breed in Britain, though but one—the Ectobiidæ—contains indigenous British insects.

No striking resemblance is borne by the typical cockroach to any other insect. Its next of kin perhaps —an aberrant member of the Forficulodea—approaches it most nearly in appearance; but even between these the resemblance is not very great.

One point about a cockroach which first engages attention is its extreme flatness, that is to say the narrow space which separates the dorsal from the ventral surface. This feature enables it easily to hide

* W = represented in Western Europe; B = represented in the British Isles.

away in a narrow crevice during daylight, or should it be disturbed in the course of its midnight revels.

Another point is the well-developed pronotum, which (besides often affording the means of differentiating species) serves as an efficient protection for the fore part of the body, just as the elytra, when present, may do for the hinder part (fig. 10). In ordinary circumstances the head is bent under the pronotum, so that the front of the face is turned

Fig. 10.—Pronota of males of *a*, *Ectobius lapponicus* Linnæus; *b*, *Ectobius perspicillaris* Herbst; *c*, *Ectobius panzeri* Stephens (magnified).

downwards. Though the head is usually thus hidden, and the face is inclined downwards, it can be turned upwards and outwards, till the mouth-parts project considerably forward. Two small areas close to the eyes and to the insertion of the antennæ, of a paler colour than the parts around, and frequently membranous in structure, are called fenestræ. In the males of some species they are replaced by ocelli.

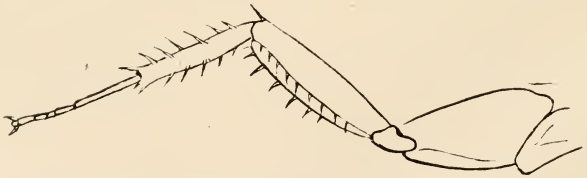


Fig. 11.—Mid-leg of *Periplaneta australasiæ* Fabricius, to illustrate the highly developed coxa and the spines on the femur and tibia (× abt. 3).

On glancing at the ventral surface we are at once confronted with two other striking points in cockroach anatomy—the enormous development of the coxæ of all the legs, and the spiny armament of the tibiæ (fig. 11).

In recent cockroaches the elytra and wings almost always differ considerably in both shape and texture.

Amongst the various species, too, there is much diversity in their length compared with that of the abdomen, being longer in some, abbreviated in others, while from some species they are absent altogether. In certain cases the wings are less fully developed than the elytra, while the length of these appendages may be different in the two sexes. It might seem that here we have a ready means of grouping the various genera and species, but in practice it is found that the relative development of the alar organs is of

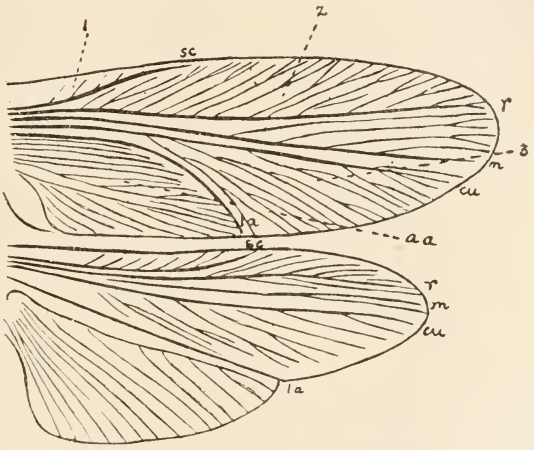


Fig. 12.—Elytron and wing of *Periplaneta americana*. *sc*, subcosta; *r*, radius; *m*, medius; *cu*, cubitus; 1*a*, first anal nervure; *aa*, anal area containing the remaining anal nervures. 1, area between margin and subcosta; 2, area between subcosta and radius; 3, area between radius and first anal nervure.

slight importance, as indeed is the case throughout the Orthoptera.

In accordance with recent nomenclature of insect wing-neuration the following, omitting the costa, are the main nervures of the elytron of a cockroach :—

1. The *subcosta*, in some descriptions called the mediastinal nervure.
2. The *radius*.
3. The *medius*.

4. The *cubitus*. This and the previous one replace what were known as the two branches of the median, or the anterior and posterior ulnar nervures.

5. The *first anal nervure*, in the region where the elytron is divided into anterior and anal parts.

6. The *remaining anal nervures*, filling the anal area.

The areas thus formed are :

1. That between the margin and the subcosta, sometimes called the mediastinal.

2. That between the subcosta and the radius, sometimes called the scapular.

3. The median between the radius and the first anal nervure, which may be subdivided if necessary.

4. The anal area, comprising the rest of the elytron.

In the wing the principal nervures hold the same relative positions. The anal area, which at rest is folded longitudinally like a fan, often occupies more than half the wing and is much more delicate in structure than the anterior part, which in texture resembles, to a great extent, the elytron. Wings and elytra are both well filled with branches of the several nervures. It should be noticed that when the alar organs are folded there is no mid-dorsal suture, but the left elytron overlaps the right. In the wing of *Ectobius* (and some other genera) there is a small "apical triangular area," which gives the wing a distinctive appearance. This area folds independently of the rest of the wing (see fig. 14).

In each sex there appear to be ten abdominal segments, besides a couple of "podical plates," lying one on each side of the anus, which, according to Huxley, may represent the dorsal part of an eleventh. The first segment is rudimentary, especially the ventral plate. In the female the 8th and 9th segments are visible only when the abdomen is distended. In the same sex the ventral plate of the 7th segment is of large size, and in the hinder part boat-shaped to assist in the discharge of the oötheca. The ventral plate of the 7th segment is called the *lamina subgenitalis*; in the male the ventral plate of the 9th segment

goes by the same name. The lamina subgenitalis is the last visible ventral plate in both sexes. The 10th dorsal plate is called the *lamina supra-analis*, and is different in shape in the two sexes.

From beneath the edges of the 10th segment in both sexes spring the cerci, which vary in shape and are usually jointed, the number of segments in *Blatta orientalis* and *Periplaneta australasiæ* being sixteen. Seeing that these appendages are supplied with large nerves, it would seem that they are not merely ornamental; perhaps they serve as posterior antennæ.* They seem often to vary in development almost in direct proportion to that of the alar organs, being to all appearance absent in many wingless forms, though search will reveal them as small plates.

Besides the cerci the males in some species have, projecting from the lamina subgenitalis, two styles. These are absent from the adult females, though they are present in the nymphs. Perhaps they are homologues of the true legs, and, if so, constitute one more point tending to show how old, as a family, the cockroaches are. The males of some species have glands on the dorsal surface of the abdomen, towards the apex, which may be "scent" glands. There are ten pairs of spiracles, eight being on the abdomen, and two on the thorax between the bases of the legs.

Occasionally a female may be noticed with a horny purse-like capsule protruding from the hinder end of her abdomen. This is the oötheca or egg-case (fig. 13). It is formed inside the body of the female, and in *B. orientalis* contains sixteen eggs in two rows of eight. Till that number is complete the case is carried about, and then, after a time—some days maybe—it is deposited. In many cases the oötheca is wanting, and it is possible that cockroaches of the past had it not, for Brogniart credits some with an exserted ovipositor. In some cases the oötheca is retained within the brood-

* It seems that olfactory sense organs are considered to be borne by the cerci, as well as by the antennæ (Hauser, Forrel, etc.).

pouch of the mother, and so the young are born alive; in other cases, even, the oötheca is replaced by a simple transparent membrane also retained within the brood-pouch. Some cockroaches exhibit "maternal solicitude" by carrying their lately-hatched young.*

When newly hatched the young are white with black eyes; but they soon assume their proper colour. They closely resemble the adults except for the absence of wings. Post-embryonic development is slight—another sign of antiquity in the cockroach group. At the fifth to the seventh ecdysis (the number is uncertain) the nymph becomes an imago,

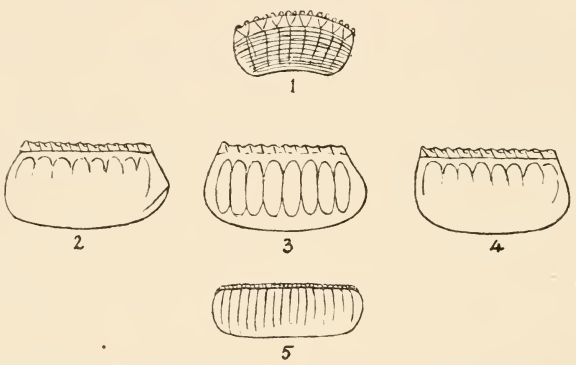


Fig. 13.—Oöthecæ of cockroaches. 1, of *Ectobius lapponicus* (× about 7); 2 and 3, of *Blatta orientalis* (× 2), 3 with one face of the oötheca removed to reveal the row of eggs; 4, of *Periplaneta americana* (× 2·5); 5, of *Blattella germanica* (× 2·5).

and, in the winged species, bears the organs of flight. How long an individual cockroach may live is doubtful, but it is supposed that the term of its existence may, under favourable circumstances, extend to five years.

It is interesting to note that Shelford found in Sarawak some very interesting cockroaches which were truly aquatic, and that Dr. N. Annandale had previously found water-cockroaches in the Malay Peninsula.†

* See Shelford's 'A Naturalist in Borneo,' pp. 117, 118.
† 'A Naturalist in Borneo,' p. 118 *et seqq.*

Cockroaches will eat almost anything—even their own dead bodies, or at any rate those of their companions—but, Miall says, "cucumber disagrees with them horribly." As regards insecticides there seems to be some conflict of opinions, but apparently phosphorus-paste may sometimes be claimed as successful. It must, however, be borne in mind that the cockroach has its place in nature. It is an effective scavenger and so far must be looked upon as a useful insect, and no doubt would be so regarded could we but conquer our rooted dislike to it, and the cockroach get rid of its unpleasant odour. Cockroaches are lovers of warmth and are really numerous only in tropical regions. British cockroaches, too, lack the beautiful colours sometimes found in foreign species.*

In the Silurian sandstone of Calvados in France, the late M. Brogniart found a fossil which he considered to be part of an elytron of a cockroach, and named it *Palæoblattina douvillei*. Brauer, however, thinks it more probably belongs to an insect like the mole-cricket, while Sharp inclines to the opinion that it does not belong to the Insecta at all. If there were no doubt concerning the identification, this fragment would represent the oldest insect known.

It is in the Carboniferous period of Palæozoic times that cockroaches first appear with certainty upon the scene—or rather, that evidences of them first appear, which is probably a very different matter. The Coal-measures of Great Britain, Belgium, and Germany, and the Coal-measures and Millstone Grit of America, have supplied a great number of cockroaches, which group of insects appears to have been more numerously represented and more generally distributed than any other at this period, which in fact has been called the "Age of Cockroaches." The Permian period has produced only a few insects, though amongst them are

* For "stridulation" in the genus *Nauphæta* see 'A Naturalist in Borneo,' p. 141.

several examples of the Blattodea; but apparently none have come to light in this country.

Passing to Mesozoic times the Triassic rocks of America have produced a number of specimens of the Blattodea, but this is not the case in Europe. In the Lias fossil insects are numerous, and examples of those we are considering are represented both in Britain and on the Continent. The Purbeck beds of the Upper Oölite have preserved several species, but they appear to be absent from the Cretaceous formations, as we should expect, seeing that a large proportion of these rocks are of marine origin and were deposited in deep water.

In Cainozoic times the Eocene period does not seem to have produced fossil cockroaches in Britain, but perhaps the conditions, under which the formations during the period were deposited, were not favourable to their preservation. The rest of the Tertiary formations are absent from, or not well represented in Britain; but the Blattodea have left *some* remains in Miocene strata on the Continent, and a few have been preserved in amber. In the Post-tertiary period fossil insects are rare, except Coleoptera, to which Order all must perhaps be referred.

Judging by the wings, from which almost entirely our knowledge of fossil cockroaches is derived, these insects are found to bear a close general resemblance to recent forms. They, however, present three important differences. First, the elytra and wings were similar in appearance and transparent; second, the same number of nervures was developed in both, whereas in recent forms they are reduced in number in the elytra; third, the arrangement of the nervures in the anal area was different. In fact the wings, rather than the elytra, of recent cockroaches preserve more closely the appearance of both wings and elytra of fossil forms. Since Palæozoic times cockroaches appear to have decreased in *numbers* greatly, if not so much in *size*, and they must now be looked upon as

but a dwindling remnant of a dying race. Let the careful housewife find in this fact what consolation she can : at any rate she may rejoice that the Carboniferous period is past and that she is not required to combat the host of cockroaches which luxuriated in the warm, moist climate of that far-distant age.

If we were to admit to the British list all the cockroaches which under any circumstances have occurred in Britain, the number of species would be quite considerable. It would be necessary to group them in three categories :

a. Three **natives**, that is, undoubtedly indigenous species.

b. Five **naturalised aliens**,* which seem now to be thoroughly established and to breed here, though not under natural conditions.

c. **Casual visitors**—a large number, which should not, however, appear on our list, and which therefore I shall do little more than mention.

In the first group are three insects only : *Ectobius lapponicus* Linn., *E. perspicillaris* Fuessly, and *E. panzeri* Steph. All live out of doors, on bushes, amongst herbage, and in similar situations. They are small, active insects, very delicate in structure, and with nothing at all repulsive in their appearance (Pl. VIII). Of the five in the second group *Blatta orientalis* Linn. has been long established; *Blattella germanica* Linn. and *Periplaneta americana* Linn. were the next to settle down amongst us; *P. australasiæ* Fabr. followed later; while *Leucophæa surinamensis* Linn. is quite a recent introduction to our fauna. Of the casual visitors none seem at present to show any inclination to establish colonies in the British Isles.

* Shelford (' Ent. Rec.' 1912, p. 217) considered the following five species to be cosmopolitan :—(1) *Blattella germanica* Linn. (2) *Periplaneta americana* Linn. (3) *P. australasiæ* Fabr. (4) *Rhyparobia maderæ* Fabr. (5) *Leucophæa surinamensis* Linn. *Blatta orientalis* Linn. is also of wide distribution. All except *B. orientalis* are properly tropical insects, though they may sometimes extend into temperate regions, where, however, they do not seem able to establish themselves naturally.

Artificial Key to British Blattodea.

A. Indigenous; living under natural conditions; small.	about	
(*a*). Pronotum dark, with pale margins . . .	*10 mm.	*E. lapponicus.*
(*b*). Pronotum pale, with a few darker dots . .	9 mm.	*E. perspicillaris.*†
(*c*). Pronotum pale, with dark markings on disc; very small	8 mm.	*E. panzeri.*
B. Naturalised; living under artificial conditions; larger.		
(*a*). Dark; wings rudimentary in female, truncated in male	25 mm.	*B. orientalis.*
(*b*). Wings developed in both sexes.		
i. Femora with spines.		
(1). Ochreous-brown; two dark lines on pronotum; rather small .	13 mm.	*B. germanica.*
(2). Sienna-brown; pronotum nearly concolorous; large .	35 mm.	*P. americana.*
(3). Sienna-brown; pronotum with yellow margin; mediastinal area of elytra yellow; large . .	27 mm.	*P. australasiæ.*
ii. Femora without spines.		
(1). Very dark; pronotum chiefly black; size moderate . .	20 mm.	*L. surinamensis.*

* Approximate length from front of head in resting position to tip of abdomen. As cabinet specimens naturally dry in this position, such measurements are most convenient for purposes of comparison.

† Although, as is usually done, *E. perspicillaris* is here treated as distinct from *E. lapponicus*, it may ultimately be necessary to place them together as two forms of the same species. The males are certainly unlike in appearance; but in the females of *E. lapponicus* the dark centre to the pronotum often tends to disappear, while the organs of flight vary in development. Consequently the suspicion arises that we may not really be dealing with two distinct species. Further examination of the two forms, especially in the way of intermediates, is called for.

COMPARATIVE TABLE OF THE THREE BRITISH ECTOBII.

	E. lapponicus.	*E. perspicillaris.*	*E. panzeri.*
1. Size . .	10 mm.	9 mm.	8 mm.
2. Colour .	Dark yellowish-grey.	Straw-coloured.	Dark yellowish-grey.
3. Pronotum.	Dark with pale borders.	Pale, almost concolorous.	Pale with darker marks.
4. Elytra, ♂ .	Fully developed.	Fully developed.	Fully developed,
5. Elytra, ♀ .	Reaching fourth segment.	Fully developed, a little shorter than in ♂.	Reaching third segment.
6. Wings ♂ .	Fully developed.	Fully developed.	Fully developed.
7. Wings ♀ .	Rudimentary.	Fully developed, a little shorter than in ♂.	Rudimentary.
8. Legs . .	Rather dark.	Pale.	Usually dark.
9. Abdomen .	Dark except apex.	Ochreous, with marginal darker spots.	Dark, paler along centre.
10. Cerci .	Blackish.	Pale.	Very dark.

Genus 1. **ECTOBIUS** Stephens.

Ectobius STEPH. Illus. Brit. Ent. Mand. VI, p. 45. . . . 1835.
Ectobia WESTWOOD Intro. Mod. Class. Ins. II, p. 44. . . . 1840.
Blatta auctorum.

When founding the genus Stephens gave the following characters:—"*Antennæ* glabrous, very slender; *head* nutant; *thoraæ* rounded in front, and concealing the head, slightly produced in the middle behind; *eyes* small; *elytra* in the males as long as the abdomen, with a single curved channel towards the base; *wings* generally complete in both sexes; *body* oblong, more or less depressed above, mostly glabrous, sometimes slightly pubescent above; *abdomen* of the males furnished at the apex with two jointed processes only, but destitute of styles; in the female the terminal segment is not carinated beneath; *legs* moderate, posterior rather the longest; *femora* rarely with spines beneath; *tibiæ* with spines on the outer edge; *tarsi* with the three basal joints gradually diminishing in length, the basal one not so long as the four others

united; *claws* without a cushion between them." (Stephens, 'Ill. Brit. Ent. Mand.,' VI, p. 45 (1835).) It should be noted further that the folded elytra do not cover the .scutellum. The "apical triangular area" of the wings (an interesting feature of our native cockroaches) is rather conspicuous. On the anterior margin of the underside of the femora are two spines. The supra-anal plate in both sexes is narrow and transverse, and the sub-genital plate of the male has no styles. The genus as at present constituted contains some fourteen species. The type of the genus is *Ectobius lapponicus* Linn.

1. **Ectobius lapponicus** Linn.

(Plate VII, fig. 1; Pl. VIII, figs. 1 and 2; and fig. 14 in text.)

lapponica Linn. Syst. Nat. (Ed. x), tom. i, p. 425, No. 8 . . . . . 1758—*Blatta.*
„ Linn. Faun. Suec. p. 235 . . . 1761—*Blatta.*
„ Curtis Brit. Ent. No. 556, figs. . . 1835—*Blatta.*
lapponicus Steph. Ill. Br. Ent. Mand. vi, p. 46, pl. xxviii, f. 7. . . . . 1835—*Ectobius.*
lapponica Brunner Nouv. Syst. Blatt. p. 53, pl. i, f. 1 . . . . . 1865—*Ectobia.*
„ Brun. Prod. der Eur., Orth. p. 31, f. 7 . 1882—*Ectobia.*
„ Eland Shaw Syn. Brit. Orth. in Ent. Mo. Mag. p. 367, f. 1 . . . . 1889—*Ectobia.*
„ Finot Faune de la France, Orth. p. 77, ff. 42–44 . . . . . 1889—*Ectobia.*
„ Burr Brit. Orth. p. 21, pl. ii, f. 1 . . 1897—*Ectobia.*
Lapponica Kirby Syn. Cat. Orth. i, p. 61 . . 1904—*Ectobia.*
lapponica Shelford Gen. Ins. fasc. 55, p. 7, pl. i, ff. 3, 8*a*, 8*b* . . . . . 1907—*Ectobia.*
„ Burr Syn. Orth. W. Eur. p. 12 . . 1910—*Ectobia.*
lapponicus Lucas Proc. S. Lond. Ent. Soc. p. 35, pl. iii, ff. 1, 1*a*, 1*b* . . . . 1915—*Ectobius.*

(Other synonyms are:—*hemiptera* Fabr.; *sylvestris* Scop.; *nigrofusca* De Geer; *lucida* Hagenbach; *helvetica* Hagenb.; *germanica* Desmarest. Stephens ('Ill. Br. Ins.' vi, p. 47) gives *E. perspicillaris* Fues. as British, but Eland Shaw found that his specimen in the British Museum is *E. lapponicus* Linn.)

Original Description.

lapponica. 8. B. flavescens, elytris nigro maculatis. *Fn. svec.* 618. *Habitat in*, Lapponiæ *imprimis, casis, consumit Pisces.* (C. Linnæus, 'Syst. nat.,' Tom. i, p. 425. 1758.)

863. BLATTA *lapponica* flavescens, elytris nigro maculatis. Fn. 618. Habitat in casis *Lapponum* sylvaticorum inter piscium squamas frequentissima. Dum pisces absque sale a Lapponibus exsicantur, sæpe unico die, ab hac omnino consumuntur.

DESCR. Magnitudo majoris muscæ. *Thoracis* clypeus membranaceus, patens, marginatus, ovalis, diaphanus. *Elytra* membranaceo-pellucida, cornei coloris, stria longitudinali elevata, in qua striæ ducuntur versus posteriores margines utrinque, ut coëant in striam longitudinalem minores ad angulum acutum; puncta aliquot nigricantia temere elytris adspersa. *Pedes* cornei coloris: *tibiæ* spinosæ. *Antennæ* longæ, setaceæ. *Alæ* inferiores aqueæ. *Cornicula* duo articulata, recurva supra anum.

(C. Linnæus, 'Fn. Suec.,' p. 235, 1761.)

MALE IMAGO (Pl. VIII, f. 1).—*Colour* dark yellowish-grey. *Length** (head hidden) 10–11 mm. *Head* and *antennæ* blackish; *pronotum* dark, or even black, with pale, pellucid borders. *Elytra* fully developed, pale

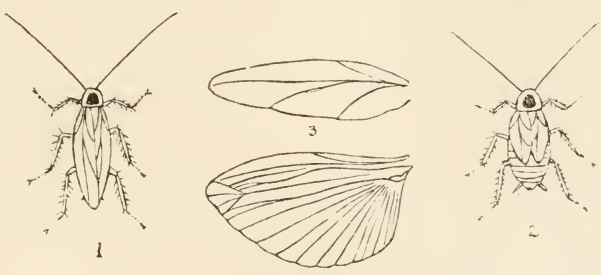


FIG. 14.—*Ectobius lapponicus* Linnæus. 1, male, 2, female (× 1·5); 3, elytron, and 4, wing (more highly magnified).

yellowish-brown, with a few darker blotches, and a number of small black spots; nervures pale. *Wings* fully developed, smoky-brown. *Legs* often dark, or partly so. *Abdomen* shining, dark except at the apex. *Cerci* blackish.

FEMALE IMAGO (Pl. VIII, f. 2).—*Colour* much paler usually, and wanting the dark centre to the pronotum. *Length* 8–9 mm. *Elytra* truncate, not extending beyond the fourth segment of the abdomen. *Wings* rudimentary. *Abdomen*, shining, dark except margins and apex.

* Length of the cockroaches is taken in "rest position"—with head hidden.

Oötheca (fig. 13, no. 1).—Bright sienna-brown, having somewhat the appearance of a small leguminous seed. On 5 July 1902 several *E. lapponicus* were taken at Boldermere, near Wisley in Surrey—in one instance a pair *in copula*. The female was rather smaller, much lighter, rounder in outline, and possessing shorter elytra, than the male. These were taken home alive. On 19 July the female was protruding a pale yellowish-brown oötheca—at any rate on that day it was first noticed, and she had been looked at most days previously. So the oötheca is not apparent till some days after copulation. The male died a day or so after capture; the female was fed on strawberry and then on banana. The oötheca was dropped on 24 July, and never became darker than palish sienna-brown. It was smaller than usually given in figures, but that may have been due to the unnatural conditions under which the female was living when it was being formed.

Nymph.—Burr* says that the nymphs are entirely black, except the sides of the pronotum which are pale. A very small one I have from the New Forest is nearly uniform sienna-brown.

Variation.—Size is fairly constant; but depth of colouring varies considerably, especially in the female. A form with generally paler colour and reddish pronotum makes a close approach in appearance to *E. perspicillaris* Herbst. On 6 May 1908 Shelford exhibited at the Entom. Society of London a species very near to *E. lapponicus*, preserved in amber.

Date.—This cockroach may be found from May to September at least. How the winter is passed does not seem to have been observed.

Habits.—*E. lapponicus* may be found under moss and dry leaves, amongst the undergrowth in woods, and, generally, on vegetation close to the ground, though it may sometimes be obtained from bushes or

* 'Syn. Orth. W. Europe,' p. 12.

trees. Curtis found it on fern in the New Forest and on white-thorns near Reading. G. T. Lyle swept a male from rushes in a damp spot on a New Forest heath. Linnæus (see above, p. 75) credits this cockroach with eating the dried fish of the Lap-landers. It often comes at night to the lepidopterist's "sugar." Whether it finds the bait by flight, or not, I cannot say. This is quite likely, for Curtis notes that he took it on the wing; and at Aldridge Hill in the New Forest, on 30 July 1909, I captured one, which readily took to flight before it was secured. This, I believe, was the first time I saw a cockroach fly.

Distribution.—Not infrequent in northern and central Europe—England, Denmark, Norway, Lapland, Finland, Holland, Belgium, France (chiefly northern), Austria. In southern Europe (Spain, etc.) it becomes less common and is more a mountain insect—on Mt. Etna for instance, and the mountains of Bosnia and Herzegovina.

British Localities.

England.—*Berks:* (*Hamm.*); near Reading (*Curtis*); Sunning Hill (*Hope Coll. Oxon*); Bagley Wood (probably); most woods in the county (*Holland*). *Devon*:* Exeter and Torquay (*Bracken*); Aldermaston, 26 June 1908 (*Tomlin*). *Essex:* Epping Forest, often comes to "sugar" (*W. Cole*, from E. N. Buxton's 'Epping Forest,' 7th ed. 1905, p. 94). *Hants:* New Forest, sometimes abundant (*Lucas*, etc.); Pamber Forest (*Tomlin*); Parkhurst Forest, Isle of Wight (*Morey*). *Surrey:* Downs near Horsley, Gomshall, etc., on left bank of Mole (*Ashdown*); Ockham Common (*Lucas*); Albury and Byfleet (*Burr*); Oxshott, 2 females, 13 Sept. 1902 (*South*); Leather-head (*Briggs*); Dorking (*Chitty*); Haslemere (*Shaw*); Devil's Punch Bowl, Hindhead (*Lucas*); Peaslake (*Carr*). *Sussex:* near Cocking, beaten from trees (*Burr*); Slindon Wood, Eartham, and Dane Wood (*Guermonprez*). (An example from Birkenhead Docks (Cheshire), and several from a dock at Bootle (Lancashire) must be looked upon as accidental importations.)

* A specimen in 1877, recorded by Parfitt as taken in the vaults of the City Bank, Exeter, was no doubt *Blattella germanica*.

2. **Ectobius perspicillaris** Herbst. (= *livida* Fabr.).

(Plate VII, fig. 3, and Pl. VIII, fig. 5.)

perspicillaris	Herbst Fuessly, Arch. Ent. p. 186, pl. 49, f. 11	1786—*Blatta.*
pallida	Oliv. Ent. Méth. iv, p. 319, n. 29 .	1789—*Blatta.*
livida	Fabr. Ent. Syst. vol. 2, p. 10, n. 23 .	1793—*Blatta.*
lividus	Steph. Ill. Br. Ent. Mand. vi, p. 48 .	1835—*Ectobius*
livida	Brunner Nouv. Syst. Blatt. p. 59 .	1865—*Ectobia.*
,,	Brunner Prod. der Eur. Orth. p. 35	1882—*Ectobia.*
,,	Eland Shaw Syn. Brit. Orth. in Ent. Mo. Mag. p. 369 . . .	1889—*Ectobia.*
,,	Finot Faune de la Fr., Orth. p. 78 .	1889—*Ectobia.*
,,	Burr Brit. Orth. p. 23, pl. ii, f. 3 .	1897—*Ectobia.*
Perspicillaris	Kirby Syn. Cat. Orth. p. 63 . .	1904—*Ectobia.*
perspicillaris	Shelford Gen. Ins. fasc. 55, p. 7, pl. i, f. 7	1907—*Ectobia.*
livida	Burr Syn. Orth. W. Eur. p. 13 .	1910—*Ectobia.*
perspicillaris	Burr Syn. Orth. W. Eur. p. 152 .	1910—*Ectobius.*
,,	Lucas Proc. S. Lond. Ent. Soc. p. 35, pl. iii, f. 3	1915—*Ectobius.*

(Other synonyms are *Brunneri* Seoane, and *concolor* Hagenb.)

Original Description.

*12. *Perspicillaris.* Reppen. Tab. xlix, fig. 11.

Fabricius hält zwar diese Art nur für eine Varietät der *Bl. lapponica*; allein ich glaube doch, es sen eine eigne Art, weil ich sie nie hier gefunden habe, wo doch die *Bl. lapponica* so häufig ist; hingegen habe ich sie in Reppen gefunden, wo ich jene niemals wahrgenommen. Sie hat grade die Gestalt des Weibchens von der *Bl. lapponica*, welches, wie bekannt, so viel kürzer ist. Die Deckschilde haben auch die Reihe brauner Punkte, aber der Brustschild ist an den Seiten ganz durchscheinend, wie Glas, und in der Mitte röthlich gelb; Fühlhörner and Füsse sind ganz blass und halbdurchscheinend, die bey jenen dunkler sind. (Herbst, Fuessly, 'Archiv,' p. 186, 1786.)*

10. *B. Perspicillaris*, Pl. 49, fig. 11, variet. *B. Lapponicæ* Fabr. Ent. Syst. ii, p. 10, n. 21. Elle ressemble parfaitement à la femelle de *Lapponica*, qui est plus courte que le mâle. Les élytres ont aussi une rangée de points noirs; mais le corcelet a les bords transparens et n'est fauve qu'au milieu. Les antennes et les pattes sont pâles et demi transparentes, tandis qu'elles sont obscures à la *Lapponica*. (Archives de l'histoire des Insectes, publiées en allemand par Jean Gaspar Fuessly. Traduites en Français. Winterthour, 1794, p. 171.)

livida. 23. B. livida immaculata elytris ad angulum acutum striatis. Geoff. Ins. i, 381, 3.

Habitat in Gallia. Mus. Dom. Bosc.

Affinis Bl. lapponica. Antennae corpore longiores, fuscae. Thorax, elytra striata, corpus pallida immaculata.

(Fabr. 'Ent. Syst.' ii, p. 10, n. 23, 1793.)

* *E. perspicillaris* of Stephens ('Ill. Br. Ent.' vi, p. 47) = *E. lapponicus* (vide Eland Shaw in 'Ent. Mo. Mag.' 1889, p. 368).

Male Imago (Pl. VIII, f. 5).—General *colour* pale ochre or straw colour. *Length* about 9 mm., intermediate between that of *L. lapponicus* and *L. panzeri*. *Head* and *antennæ* slightly redder than the general colour; *eyes* nearly black. *Pronotum* (fig. 10 *b*) reddish-ochre, with slightly darker marks on the disc, and pellucid margins. *Elytra* lanceolate with very inconspicuous dark dots, reaching beyond the tip of the abdomen. *Wings* fully developed, costal region pale ochre, the remainder nearly colourless. *Legs* pale, with a transparent appearance. *Abdomen* reddish ochre, with a row of darker marks along each side. *Cerci* pale, similar in colour to that of the abdomen.

Female Imago.—Rather broader in build and not quite so long, but otherwise much like the male. Elytra and wings shorter than those of the male, but both fully developed.

Oötheca.—Brunner ('Prodromus,' p. 35) says: "Oothecae ab illis *E. lapponicae* L. haud diversae"—The oötheca differs little from that of *E. lapponicus*. At present I have not seen a female with one.

Nymph.—Again I quote Brunner, who says: "Larvae primi stadii thorace ferrugineo, abdomine fusco, stadiorum posteriorum unicolores ferrugineae, fronte et segmentis thoracis disperse fusco-punctatis"—In the first stage the nymphs have a rust-coloured thorax and dark abdomen; in later stages they are uniformly rust-coloured with the "forehead" and thorax bearing scattered dark dots.

Variation, etc.—Apparently *E. perspicillaris* does not vary much in either size or colour. The general tint, including that of the cerci, may at times be darker. *E. pallidus* of Stephens* is not a distinct species, but Eland Shaw,† after examining in the British Museum what are believed to be the types, thinks that it is a rather dark form of *E. perspicillaris*.

* 'Ill. Brit. Ins.' vi, p. 48.
† 'Ent. Mo. Mag.' 1889, p. 369.

Date.—Records of captures that have come under my notice extend from the 17th of June till the 26th of September; but August and September seem to be the best months in which to obtain imagines. Presumably this species passes the winter in the same way as the other two British species of *Ectobius*, whatever that may be—as imagines seems most reasonable.

Habits, etc.—Unfortunately little has been observed in Britain in connection with the habits and life-history of this cockroach—very little in fact with regard to any of our Ectobii. It has been obtained from oak and Scotch-fir (*Milton*); on sand-dunes and amongst bracken (*Buxton*); on the entomologist's "sugar" at Studland in Dorset (*Buxton*); under dead leaves in the New Forest in September (*Eland Shaw*); flying actively in hot sunshine on Wrotham Down in Kent (*Buxton*).

Distribution.—*E. perspicillaris* is widely distributed in central and southern Europe, but is not very common towards the north, its place being taken apparently by *E. lapponicus*. It has been found at least in the south of England, in Holland, Belgium, France, Germany, Austria, Spain, Italy, Dalmatia, and Algeria.

British Localities.

Apparently this cockroach is not frequent in England, and of the records that have been made over a considerable number of years one would like to feel certain that all refer without doubt to this species and never to *E. lapponicus*, for pale examples of the latter might quite easily be mistaken for darker examples of the former if indeed the species are distinct. The only specimens I possess were taken in the district between Leatherhead and Dorking in Surrey.

Records are:

England.—*Devon:* var. *pallidus* (*Stephens*). *Dorset:* Lulworth Cove, 18 Sept. (*F. W. Edwards*); Studland, 5 July (*Buxton*); Ferndown, near Wimborne Minster (*Sopp*); Portland (*C. W. Dale*); Glanvilles Wootton (*J. C. Dale*). *Hants:* Bournemouth, one (*Harwood*); New Forest (*Eland Shaw*); var. *pallidus*, New Forest (*Stephens*). *Sussex:*

Hastings District (*Bloomfield*); Slindon, no males (*Guermonprez*); Fair Mile, Dane Wood, Eartham, Charlton Forest, Bognor, Cocking, and Itchenor (*Guermonprez*). *Surrey:* common in several parts of Mickleham and on Box Hill, all on the right bank of the River Mole (*Ashdown*); Woking (*Saunders*); Reigate, 26 Sept. (*Chapman*). *Middlesex:* Ruislip (*McLachlan*). *Kent:* Broadwater Forest near Tunbridge Wells, early Sept. (*Milton*); Blean Wood, Faversham (*Chitty*); Wrotham Down, 17 June (*Buxton*); Darenth Wood and Birch Wood (*Stephens*).

(An example from Birkenhead Docks (*Cheshire*) was clearly a casual introduction.)

3. **Ectobius panzeri** Steph.

(Plate VII, fig. 2, and Pl. VIII, figs. 3 and 4.)

Panzeri	Steph. Ill. Brit. Ent. Mand. vi. p. 47 .	1835—*Ectobius.*
ericetorum	Wesmaël 1838. Bull. Acad. Brux. v, p. 587, tab. i, f. 2	1838—*Blatta.*
,,	Brunner Nouv. Syst. Blatt, p. 58 .	1865—*Ectobia.*
,,	Brunner Prod. der Eur. Orth. p. 34 .	1882—*Ectobia.*
Panzeri	Eland Shaw Syn. Brit. Orth. in Ent. Mo. Mag. p. 368	1889—*Ectobia.*
ericetorum	Finot Faune de la France, Orthopt. p. 77, f. 45	1889—*Ectobia.*
panzeri	Burr Brit. Orth. p. 22, pl. ii, f. 2 .	1897—*Ectobia.*
Panzeri	Kirby Syn. Cat. Orth. p. 62 . .	1904—*Ectobia.*
panzeri	Shelford Gen. Ins. fasc. 55, p. 7 .	1907—*Ectobia.*
,,	Burr Syn. Orth. W. Eur. p. 12 . .	1910—*Ectobia.*
,,	Lucas Proc. S. Lond. Ent. Soc. p. 35, pl. iii, f. 2	1915—*Ectobius.*
nigripes	Steph. Ill. Brit. Ent, Mand. vi. p. 48 (var.)	1835—*Ectobius.*

(Other synonyms are: *germanica* Panzer; *concolor* Serv.; *arenicola* Fisch.)

Original Description.

Ectobius panzeri. *Elongatus, pallide-ochraceo-flavescens, thoracis disco testaceo-fusco, elytris pallidis lateribus membranaceo-pellucidis, disco ferè immaculato, antennis pedibusque piceis.* (Long. corp. 5–6 lin.) Bl. Panzeri. *Steph. Catal.* 304, *No.* 3360.—Bl. germanica. *Panzer Faun. Germ.* ii, f. 16.

Slightly elongate, or elliptic; of a pale ochreous yellow; head dusky; mouth pale; thorax with its disc testaceous-brown, sometimes a little blackish, the margins pale and pellucid; elytra also pale, the lateral margins pellucid brownish-yellow, the disc with a few minute brownish atoms; abdomen beneath pitchy, above pale testaceous brown; legs pale pitchy, the femora palest and without spines; antennæ also pitchy. (J. F. Stephens, 'Illustr. Brit. Ent. Mand.' vi, p. 47, 1835.)

[Ectobius nigripes. *Elongatus, ochraceo-flavescens, thoracis disco antennis pedibusque nigris, tarsorum articulo basali coxisque albidis.* (Long. corp. 6 lin.)

Bl. nigripes. *Steph. Catal.* 304, *No.* 3361.

Elongate-ovate, or elliptic; ochreous-yellow, with a brownish tinge; head, antennæ, and eyes, black; thorax with its disc black, the margins pale testaceous and pellucid; elytra pale yellowish-brown, or ochreous, with some remote, somewhat indistinct, darker atoms on the disc, especially towards the apex; abdomen black beneath, dark brownish-ochre above, with a black streak on each side; legs black, with the coxæ pale ochreous, the base of the tarsi whitish; femora without spines. (Steph. 'Illustr. Brit. Ent.' Mand. vi. p. 48, 1835.)]

Male Imago (Pl. VIII, f. 3).—*Colour* dark yellowish-grey. *Length* up to 8 mm. *Head* and *antennæ* very dark, a pale streak between the eyes; *pronotum* (fig. 10 *c*) yellowish, with pellucid lateral margins, and dark blotches on the disc almost forming two longitudinal lines. *Elytra* pale yellowish with many dark dots, lanceolate, extending beyond the tip of the abdomen. *Wings*, pale smoky, iridescent. *Legs* yellowish, darker at the joints. *Abdomen* above yellowish along the centre, but dark along the sides. *Cerci* very dark.

Female Imago (Pl. VIII, f. 4).—*Colour* as in the male. Length 8 mm., or less. *Pronotum* less spotted. *Elytra* truncate, not extending beyond the third segment of the abdomen. *Wings* rudimentary. Each segment of the *abdomen* with an irregular dorsal band of black blotches.

Oötheca.—In colour the oötheca is dark chestnut, while in size and general appearance it is very like that of *E. lapponicus*. The female is sometimes found carrying its oötheca—e. g. one at Blackgang Chine, Isle of Wight (Hope Coll. Oxford), one at St. Helens, I. of Wight, 25 August 1909 (*Donisthorpe*), one at Chapman's Pool near St. Alban's Head, 26 August 1905 (*Tomlin*), one at Beaulieu Heath in the New Forest 1 September 1909 (*Lucas*). King took a pair *in copula* in the New Forest, 9 August 1898. These dates tend to show that the species breeds at the end of the summer. The abbreviated elytra of the female give one the impression at first that a nymph is carrying an oötheca.

Nymph.—Except for the lack of the abbreviated elytra, the nymph looks much like a small female; it may, however, be known by the presence on the dorsal surface of the thorax of a large, very distinct, black mark, something like a capital A with very short legs.

Variation.—In colour this little cockroach varies a great deal, but not in size. In Britain it is usually a rather dark insect, some specimens being so dark, especially in the legs, that they appear almost black. Stephens described this very dark form as a distinct species under the name of *nigripes* (p. 82).* The fact is, however, that generally speaking the insect becomes darker the farther north it is found. English examples may belong to either form, but apparently the majority are distinctly black. When darkening occurs the pale vertex seems to remain unaltered, and even shows up the more distinctly amidst the dark surroundings: the pale line, too, along the centre of the pronotum remains to some extent; while the basal segment of the tarsi seems to be constantly pale also. Var. *concolor* Serv. is of a uniform pale tint. This form occurs in central and southern Spain, on the north coast of Portugal, and in Dalmatia.

Date.—There are records of the occurrence of *E. panzeri* from June till past the middle of September. Most of them are in August, which seems to be the best month for the adult insect. In June and, to a less extent, in July many will still be nymphs. How the winter is passed seems not at present to have been ascertained.

Habits, etc.—On 8 August 1896 I first made personal acquaintance with this cockroach, having found it on that date in some numbers near Christchurch in Hants. They were under dried seaweed and other rubbish only a few yards from the shore, on ground that would apparently be often washed by the sea itself. They were very active, and, as soon as uncovered, scurried

* Perhaps the var. *nigripes* Steph. = *hæckeli* Bolivar.

away into the nearest hiding-place. The females were perhaps rather more common than the males, and many examples of both sexes were dark, especially in the legs. They were very soft and tender and soon succumbed in the cyanide-bottle. Sandy ground, and especially sand hills near the coast and those covered with marrma-grass, seem to suit these little cockroaches; but they are often found on heather and other low herbage, or on the ground in healthy spots. From the herbage they may be obtained with the sweeping-net. Being so lively in their movements and at the same time so delicate, they are easily damaged when collected by hand from the ground. They come to the entomologist's "sugar." Porritt found them under old bark and rotten wood on posts adjoining the golf-links at Churston in Devon, and I met with them myself on one occasion, when breaking up a decayed tree-stump by the side of Beaulieu River in the New Forest. On another occasion, 21 August 1910, at Holm Hill, also in the New Forest, when breaking up and examining the trunk of a small dead pine that had been burnt in a heath-fire, I met with two or three specimens of *E. panzeri*. At the same time a centipede (*Scolopendra*) was captured, holding one of these cockroaches, which apparently it had just caught. Though not dead, the cockroach moved but little: possibly the centipede may have paralysed it. While I watched, the centipede seemed to be using its poison-jaws much as if they were legs. The cockroach was held beneath the captor's body by several of the anterior pairs of legs, ventral surface upwards; I presume in order that the softer parts of its prey might more easily be devoured. The centipede seemed distressed because it could not hide, but nevertheless fed greedily on the cockroach, sometimes waving its antennæ vigorously. The centipede was livid pink in colour, a rather small species, or perhaps the young of a larger kind. I have also found *E. panzeri* hiding under the coping of the brick wall of a railway bridge in the New Forest.

DISTRIBUTION.—*E. panzeri* is found over most of western Europe — south of England; Belgium; Holland; France (especially in the north and centre); Switzerland; Spain; Portugal; sparingly in Germany, Dalmatia, and Ferrol.

BRITISH LOCALITIES.

So far as records show, this cockroach is found in the south of England only; and from them we see that its habitat extends from Cornwall through every county along the coast to Suffolk. There is also one record for Surrey.

ENGLAND.—*Cornwall:* Tresco, one of the Scilly Isles (*Burr*); Lelant (*Porritt*); Lizard (*Shaw*); Hayle (*Burr*); Kynance Cove (*Edwards*); Land's End (*J. C. Dale*). *Devon:* South Devon coast (*Porritt*); Kingsbridge and Plymouth (*Stephens*); cliffs, Wembury (*Bignell*); Whitesand Bay (*Keys*); Exmouth (*Parfitt*); Churston (*Porritt*); Tregantle (*Keys*); Berry Head (*Edwards*); Dawlish (*Lucas*); Slapton (*Champion*). *Dorset:* near Studland (*Lucas*); between Studland and the mouth of Poole Harbour (*Lucas*); Lulworth Cove (*Briggs*); Portland (*Edwards*); Chesil Beach and Glanvilles Wootton (*C. W. Dale*); St. Alban's Head (*Tomlin*); Swanage (*Buxton*). *Essex:* Clacton-on-Sea (*Harwood*); coast near Colchester (*Sopp*). *Hants:* Parley Heath (*Donisthorpe*); near Christchurch (*Lucas*); New Forest, frequently (*Lucas*); Hayling Island (*Burr*); near Bournemouth (*Ashdown*); Boscombe, 1903 (*Burr*). *Isle of Wight:* Blackgang Chine (*Hope Coll., Oxford*); Alum Bay, Totland Bay, Yarmouth, Compton Bay, undercliff at St. Catherine's Point (*Burr*); Parkhurst Forest (*Morley*). *Kent:* Deal (*Bedwell*); sandhills along the shoreline in Sandwich Bay from Deal to Shellness (*Burr*); Sunny Carvett near Lydden (*Burr*). *Suffolk:* Lowestoft (*Saunders*); Coston sandhills and Felixstowe sandhills (*Morley*). *Surrey:* Thursley, one (*Dalgliesh*). *Sussex:* Camber Sands (*Bloomfield*).

(var. *nigripes* has been recorded from Lelant, Lizard, Whitesand Bay, Exmouth, Lulworth Cove, Portland, New Forest, Bournemouth, Boscombe, and near Christchurch. No doubt many additions might be made to this list).

Genus 2. **BLATTELLA** Caudell.

Phyllodromia SERVILLE Orth. p. 105 . . . . . 1839.
Phyllodromia BRUNNER Nouv. Syst. Blatt. p. 88 . . . 1865.
Blattella CAUDELL Notes Nom. Blatt. (Proc. Ent. Soc. Wash. v, No. 3, p. 232) . . . . . 1903.

Our single species, *B. germanica*, used to appear in the genus *Phyllodromia* Serv., which was thus diagnosed:

Abdomen conique, plus allongé que dans la première division [i.e. "Blatte vraie, *Blatta propriè dicta*"] dans les mâles surtout; diminuant sensiblement de largeur, dès sa base. Plaque sousanale des mâles, en cône allongé et pointu. Septième ou dernier segment abdominal, de même largeur à peu près que le sixième, et point échancré: taille ordinairement petite. (Phyllodromie, *Phyllodromia*.) (Φύλλον, feuille; δρέμω, je cours.) (Serville, 'Ins. Orth.' p. 105 (1859).)

Phyllodromia was, however, preoccupied in the Diptera; so in 1903 A. N. Caudell proposed *Blattella* for *Phyllodromia*, the type being *Blatta germanica* of Linnæus. Most orthopterists followed him but R. Shelford did not, because it was obvious that *Phyllodromia* was in need of revision and subdivision. Shelford came to the conclusion that *Phyllodromia* Serv. should be split into at least six genera, one of which is *Blattella* Caud., and the others *Neoblattella* Shel., *Margattea* Shel., *Supella* Shel., *Eobatta* Shel., and *Chorisoblatta* Shel.

Diagnosis of *Blattella* Caud. in Shelfordian sense:

Antennæ setaceous. Tegmina and wings exceeding the apex of the abdomen. Tegmina with longitudinal discoidal sectors. Wings with the anterior part rather narrow, scarcely tapering to the base, ulnar vein simple or bifurcate, very rarely tri-ramose, no apical triangle. Front femora armed on the anterior margin beneath with a complete row of spines, the more distal shorter than the more proximal. Sexes similar. Oötheca coriaceous, carried by the female with the suture directed to one side. Type of genus —*Blatta germanica* Linn. ("Preliminary diagnoses of some new genera of Blattidæ," 'Ent. Mo. Mag.' 1911, p. 154.)

1. **Blattella germanica** Linn.

(Plate VI, fig. 2; Pl. VII, fig. 4; and fig. 15 in text.)

germanica	Linnæus Syst. Nat. ii. p. 688 .	1766—*Blatta.*
germanicus	Steph. Ill. Br. Ent. Mand. vi, p. 46, n. 1	1835—*Ectobius.*
germanica	Westw. Intro. Mod. Class. Ins. I, p. 515, f. 51	1839—*Ectobia.*
,,	Serv. Orth. p. 107, n. 36 . .	1839—*Phyllodromia.*
,,	Brunner Nouv. Syst. Blatt. p. 90, pl. ii, f. 7	1865—*Phyllodromia.*
,,	Brunner Prod. der Eur. Orth. p. 46, pl. i, f. 9.	1882—*Phyllodromia.*
,,	Eland Shaw Syn. Br. Orth. p. 370 (Ent. Mo. Mag.)	1889—*Phyllodromia.*
,,	Finot Faune de la Fr. Orth. p. 81, f. 47	1889—*Phyllodromia.*
,,	Burr Br. Orth. p. 23, pl. ii, f. 4 .	1897—*Phyllodromia.*
,,	Kirby Syn. Cat. Orth. i. p. 87 .	1904—*Phyllodromia.*
,,	Burr Syn. Orth. W. Europe, p. 16	1910—*Phyllodromia.*
,,	Burr Syn. Orth. W. Europe, p. 152	1910—*Blattella.*
,,	Lucas Proc. S. Lond. Ent. Soc. p. 36, pl. iii, f. 4	1915—*Blattella.*

Original Description.

germanica. 9. B. livida, corpore flavescente, thorace lineis duabus nigris parallelis.

Habitat in Dania. *Brunwiche.*

Corpus *flavescens, magnitudine B. lapponicæ*. Thorax *uti elytra magis liventia : lineæ 2 thoracis longitudinales, parallelæ nigræ, latiusculæ.*

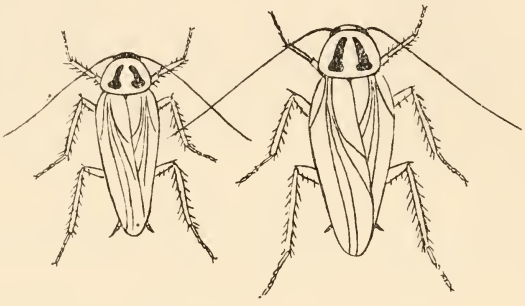
(C. Linnæus, 'Syst. Nat.' Ed. xii, tom. i, pars ii, p. 688, 1766.)

Male Imago (fig. 15 *a*).—General *colour* nearly uniform dark ochre, or tawny. *Length* 13–14 mm. *Antennæ* having the appearance of being finely ringed with brown; *eyes* black. *Pronotum* with two longitudinal distinct dark brown streaks, not quite reaching front or hind margin, but continued vaguely on meso- and metanotum; lateral margins of pronotum almost pellucid. *Elytra* lanceolate, bright ochre in colour, immaculate; *wings* ochreous in costal region, the remainder nearly colourless, nervures darker; *legs* pale; tip of tibiæ, and of tarsi usually, darker. Dorsal surface of *abdomen* darker, especially along the middle; *cerci* of the general colour, rather long.

B. germanica looks somewhat like *E. lapponicus*, but is sensibly larger, and of a brighter colour. It lacks the "apical area" of the wings, present in *Ectobius*, and has a differently marked pronotum.

Female Imago (fig. 15 *b*).—Except that it is longer and a little broader in build, the female is similar to the male. Like the male it has ample wings.

Oötheca (fig. 13, no. 5).—In appearance the oötheca of *B. germanica* is very different, not only from that of the three preceding species, but also from that of the three which follow. These six are well described



a *b*

Fig. 15.—*Blattella germanica* Linnæus. *a*, male; *b*, female (× 2).

as purse-like, but that of *B. germanica* is nearly rectangular in shape, and not so thick, compared with its length and breadth. The depressions between the chambers containing the eggs are well-pronounced. The oötheca is dark brown in colour, with a glossy surface. The length is about 7 mm., and the breadth about 3 mm. Main found that the young emerged almost as soon as the oötheca was deposited, and Blatchley (the 'Blattidæ of Indiana') confirms this. He says that *B. germanica* carries its oötheca for several days with half or three-fourths of its length protruding, and mentions the fact that one, with its oötheca in this condition, was placed in a bottle at 11 p.m. and the young had emerged at 8 the following

morning. The oötheca contains some 18–20 egg-chambers on each side, and a case is recorded in which 40 young were produced from a single oötheca. The female with this oötheca was captured by Keys in a restaurant at Plymouth. While the female is carrying the oötheca the suture is not vertical but directed to one side.

Nymph.—On first emerging from the egg the nymph is colourless. When nearing maturity it is very dark, except the legs and the lateral margins of the thorax which are tawny: the antennæ are moderately dark. The two longitudinal bands on the pronotum are very wide and but just separated by a paler line. The width of the nymph is very much greater, compared with the length, than that of the adult. *B. germanica* is credited with rapid growth, attaining full development in a few months.

Variation.—*B. germanica* is not a variable species; but it might be mentioned that Prince exhibited at the Lancashire and Cheshire Entomological Society, on 19 October 1903, a specimen taken at Birkenhead considerably darker than the type.

Date.—Since in Britain this cockroach lives under artificial conditions, and where the temperature is usually above the normal, breeding is probably continuous, and examples in all stages might be expected to occur together, as is the case with the common cockroach, *B. orientalis*. I have records of the oötheca being carried at Zool. Gardens about 1st of April (*Lucas*), at Derby 28th April (*Pullen*), in Birmingham at the end of May (*Imms*), and at Plymouth in September (*Keys*).

Habits, etc.—*B. germanica* and the four species that follow it are not indigenous in Britain, and must be described as "naturalised aliens." This species occurs wild in woods in Russia as well as in Prussia, and there seems to be no good reason why it should not establish itself out-of-doors in these islands.

Reports of its being so taken are rare, and apparently must be looked upon merely as casual occurrences. The following case, however, is interesting. On 31 January 1911, when "the country was iron-bound in a black frost," Burr found *B. germanica* and *B. orientalis* swarming within a rubbish-heap in a brickyard near Cheriton, Kent. Though the weather was very cold, the fermentation in the large heap of ashes and refuse produced much heat. In this case, of course the congenial warmth accounts for the presence of these cockroaches out-of-doors.* Finot says that there are reports of its having been found in France upon trees and under dry leaves; but he considers the cases accidental or erroneous.†

Unlike most cockroaches, this one has several common names. At Aldershot, I understand, it is sometimes called the "Shiner," which term is quite appropriate. Popular opinion in France and Russia points to Germany as the home of this cockroach, a belief which Linnæus has stereotyped in its specific name. It is therefore not surprising that in Russia it should be called the "Prussian." In Germany, however, they will have none of this, and call it the "Russian." It seems to have a liking for the neighbourhood of water-pipes and for similar situations, which may account for a Lancashire name—the "Steam-fly." At any rate it gets its American name of "Croton-bug" from its being first noticed when water from the Croton River was led into New York. In this connection it might be mentioned that it was found swarming behind hot-water pipes in 1916 at a Church Army shelter at Swansea (*in litt. H. R. Wakefield*).

In a particular locality it often swarms, but may at the same time have a very restricted range. Its migratory habits have been treated by Howard.‡ *B. germanica* is said to have been introduced into

* 'Entomologist,' 1912, p. 115.
† 'Faune de la France,' Orth. p. 81.
‡ 'Insect Life,' vii, p. 349.

England by the soldiers returning from the Crimea in 1857; but this is erroneous: it was present in parts of the British Isles before that date. For Stephens* placed it amongst the indigenous species, although he says it is extremely doubtful whether this insect is really indigenous, as it appears to be confined to dwellings and warehouses, and it occurs, not uncommonly, in merchant vessels.† Further, there is distinct evidence, from the Hope Collection in Oxford, that it was numerous in parts of Britain before the date of the return from the Crimea. There are several old specimens, one of which is labelled "Infesting the kitchens of houses at Kildare, Ireland, living behind the skirting and abounding in the crevices of the kitchen-table, destroying all kinds of paper and in many ways very troublesome, March 1852." There is another specimen labelled in the same handwriting, "Mr. Gray Dudley; taken by him in his garden at the foot of Castle Hill."‡ Kirby and Spence say that it comes out in the daytime.

Distribution.—*B. germanica* is a cosmopolitan species, and is spreading everywhere. Its home appears to be the more central and northern parts of the Palearctic region. It occurs wild in the north-east of Europe as far west as Thuringia and Saxony, the Hartz Mountains and Westphalia, and also at Koster Neuberg near Vienna. It seems to be commoner in eastern than in western Europe. Other localities for it are France (houses and vessels), Holland and Belgium, Britain, Spain, North Africa, North America, Japan, Siberia, Mexico, Ceylon, New Holland, New Guinea, Jamaica, Martinique, Chili, Paraguay, probably Australia, and no doubt many other places also.

* 'Ill. Br. Ent. Mand.' vi, p. 46, 1835.

† Kirby and Spence (1828) mention it as "abounding in some houses," i, p. 242.

‡ Burr, 'Ent. Record,' xii, 1900, p. 98. Had Dale's examples (now in Oxford) only been labelled they might have been useful in this connection.

British Localities.

At the present time *B. germanica* is well established in a number of localities—chiefly in bakeries, warehouses, hotels, restaurants, Zoological Gardens, and other similar places. It is probable that the following list is very far from exhaustive, and from some of the places mentioned it may since have disappeared. Further, it has not always been put on record whether the examples cited were settled colonists or merely chance visitors.

England.—*Berks:* neighbourhood of Radley College (*Burr*). *Cambridge:* Cambridge (*Harmer*, University Museum). *Cheshire:* Birkenhead, Borough Hospital (*Holt*); Birkenhead, docks (*Prince*); Birkenhead, two bakeries (*Sopp*); Hoylake, scarce (*Sopp*); West Kirby, in profusion in a restricted area (*Sopp*). *Cumberland:* Carlisle, Carr's Biscuit Works and elsewhere (*Day*). *Derbyshire*; Derby, where it was breeding (*Pullen*). *Devon:* a Plymouth restaurant, 1895 (*Bracken*); many houses in Plymouth (*Bignell & Keys*). *Hants:* Portsmouth, Central Hotel (*Colthrup*). *Isle of Wight:* Shanklin, one in a house, another in a grocery store (*Poole*). *Kent:* Dover and Ramsgate (*Sopp*); Cheriton (*Burr*); Isle of Sheppey, and Woolwich Barracks (*Porritt*); Blackheath, swarming in an old house (*Lucas*). *Lancashire:* Bolton, common in a cotton mill (*Midgley*); Bootle, North docks (*Sopp*); Liverpool, abundant (*Sopp*), Hanover Street (*Elliott*), in profusion in cellars in Clayton Square (*Sopp*), warehouses in Brunswick and other docks (*Sopp*); Manchester, in restaurants and the monkey-house at Belle Vue (*Chappell*); Oldham, in a cotton-mill (*Chappell*); Warrington, from Walker's Brewery (*Warr. Municipal Mus.*); Preston (*Chappell*); Didsbury, imago and nymphs, house, 1915 (*Dixon*). *Lincolnshire:* Lincoln (*Mason*). *London:* Zoological Gardens (*Shaw*); cellar in Shoe Lane (*Chitty*); Natural History Museum, S. Kensington (*Morley*); various restaurants, Queen's Gate Gardens, gravel path at St. Mary's Hospital, "Old Cheshire Cheese" Fleet Street (*Shaw*); Admiralty Restaurant, abundant (*Buckstone*). *Norfolk:* (*Edwards*). *Notts:* Mansfield (*Sopp*). *Oxfordshire:* Oxford, Randolph Hotel kitchen (*Hamm*). *Surrey:* Aldershot (*Burr*); one (probably), a nymph, known to have come to Kew Gardens with plants from India, 1897 (*Lucas*). *Sussex:* Hastings, hotels (*Burr*); Bognor, common in houses (*Carter*); Eastbourne (*Burr*). *Warwickshire:* Birmingham, two in packing-case—a female with oötheca, and a nymph

(*Imms*). *Yorkshire:* Bradford, numerous in warehouses (*Carter*); Leeds, since 1855 in one baker's shop (*Miall*); Doncaster, swarming in a house (*Corbett*); on one occasion abundant in rotting hides from India, at a tannery in Doncaster (*Corbett*); Barnsley, one (*Bayford*); abundant in a grocer's shop at Sheffield (*Bayford*).

Wales.—*Glamorgan:* Swansea, swarming at a Church Army shelter (*Wakefield*).

Scotland.—Evans says ('Annals of Scott. Nat. Hist.' Jan. 1901: "In 1897 I obtained two or three dozen examples of this small cockroach from a hotel in George Street, Edinburgh, as recorded in this magazine for 1899 (p. 117); and Dr. R. S. MacDougall informs me he got it sent from a restaurant in the town three years ago. Its occurrence, in abundance, in a newspaper office, Glasgow, in 1880, was recorded by Professor Trail in the 'Scottish Naturalist' the following year (vol. vi, p. 14)."

Ireland.—*Dublin:* Rathmines (*fide Kemp*); Gardens of Zoological Society, Phœnix Park (*fide Kemp*). *Down:* Strabane (*fide Kemp*). *Kildare:* Kildare (Hope Department, Oxford). *Armagh:* Poyntzpass (*Johnson*).

Genus 3. **BLATTA** Linn.

Blatta Linn. Syst. Nat. (ed. x), i, p. 424 . . . . . 1758.
Kakerlac Latr. Gen. Crustac. et Ins. . . . . 1806.
Kakerlac Latr. Fam. Nat. Règne Anim. p. 411 . . . . 1825.
Steleopyga Fisch. de W. Bull. Mosc. vi, pp. 356, 366 . . . 1833.
Stylopyga Fisch. de W. Orth. Ross. p. 68 . . . . . 1846.
Stylopyga Brunner, Nouv. Syst. Blatt. p. 222 . . . . 1865.

193. BLATTA. *Caput* inclinatum.
Antennæ setaceæ.
Elytra Alæque planæ, subcoriaceæ.
Thorax planiusculus, orbiculatus, marginatus.
Pedes cursorii.
Cornicula duo supra caudam.
(C. Linnæus, 'Systema Naturæ,' tom. i, p. 424, 1758.)

(Linnæus adds as a footnote—"Blattæ lucifugæ cum Larvis suis rodunt cibaria, coria, putridaque varia, celeri cursu se subtrahentes." He gives nine species: 1. gigantea, 2. ægyptiaca, 3. surinamensis, 4. americana, 5. nivea, 6. africana, 7. orientalis, 8. lapponica, 9. oblongata.)

In this genus the sexes are unlike. Antennæ are long and hairlike, and the pronotum does not cover the top of the head. Elytra and wings are variable

in their development, but they do not reach the tip of the abdomen. The legs are well armed with spines, the femora included; the pulvilli are minute. Type of the genus *Blatta orientalis* Linn., the only European species.

1. **Blatta orientalis** Linn.

(Plate VII, fig. 5; Pl. X, figs. 3 and 4; and fig. 16 in text.)

orientalis	Linn. Syst. Nat. (ed. x), i, p. 424, no. 7	1758—*Blatta.*
,,	Linn. Faun. Suec. (ed. ii), p. 234, no. 862	1761—*Blatta.*
,,	Serv. Ann. Sci. Nat. xxi, p. 29 .	1831—*Kakerlac.*
,,	Burm. Handb. Ent. ii, p. 504, no. 5 .	1838—*Periplaneta.*
,,	Fischer de W. Orth. Ross. p. 70, pl. 24, ff. 1–3	1842—*Stylopyga.*
,,	Brunner Nouv. Syst. Blatt. p. 226	1865—*Periplaneta.*
,,	Brunner Prod. Eur. Orth. p. 49 .	1882—*Periplaneta.*
,,	Miall & Denny Struc. and Life-hist. of the Cockroach . . .	1886—*Periplaneta.*
,,	Eland Shaw Syn. Brit. Orth. in Ent. Mo. Mag. p. 371 . . .	1889—*Periplaneta.*
,,	Finot Faune de la Fr. Orth. p. 83, f. 49	1889—*Periplaneta.*
,,	Burr Brit. Orth., p. 24, pl. ii, f. 5 .	1897—*Blatta.*
Orientalis	Kirby Syn. Cat. Orth. i, p. 136 .	1904—*Blatta.*
orientalis	Burr Syn. Orth. W. Eur. p. 16 .	1910—*Blatta.*
,,	Shelford Gen. Ins. Fasc. 109, p. 15	1910—*Blatta.*
,,	Lucas Proc. S. Lond. Ent. Soc. p. 36, pl. iii, ff. 5, 5*a*	1915—*Blatta.*

(Other synonyms are: *B. lucifuga* Frisch.; *B. culinaris* de Geer; *B. ferrugineofusca* Gronovius; *B. ferruginea* Thunberg; *K. castanea* Blanchard; *K. platystetho* Philippi; *B. badia* Saussure; *P. lateralis* Walker.)

Original Description.

orientalis 7. B. ferrugineo-fusca elytris sulco oblongo impresso. *Fn. svec.* 617.

Habitat in America, *hospitatur in* Oriente: *imprimis in farina, Pane etc. hodie in Russiæ adjacentibus regionibus frequens; incepit nuperis temporibus Holmiæ, uti dudum in Finlandia. Consumit Panem, cibaria, calceos etc. lucifuga.*

(C. Linnæus, 'Systema Naturæ,' i, p. 424, 1758.)

862. BLATTA *orientalis* ferrugineo-fusca, elytris sulco oblongo impressis. Fn. 617.

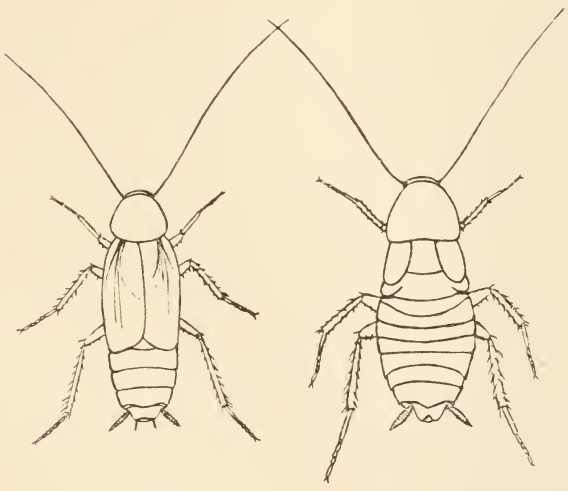
Fennonibus Torraka. Dracan.

Habitat in Molendinis, præsertim in fumosis hypocaustis Finnorum (Pyrten), ubi devastat panes, ocreas, et varia

utensilia incolarum; rarius Stockholmiæ et alibi, noctu prædatur; accensa caudela aufugit ocyus.

Descr. Magnitudo Grylli tota testaceo-fusca seu ferrugineo nigricans et quasi usta. Clypeus *thoraci* incumbens planus, ovalis, transversalis. *Elytra* diaphana, abdomine breviora, ovali-oblonga: singula tribus striis a basi exeuntibus, quarum intermedia elevata: interior excavata, incurvata conficiens cum pari spatium ovatum inclusum; exterior excavata juxta marginem, brevis; striæ absque ullo certo ordine: cauda duobus mucronibus. *Pedes* aculeati. Mas alas et elytra gerit. Fœmina ejus tantum rudimenta.
(C. Linnæus, 'Faun. Suec.' p. 234, 1761.)

Male Imago (Pl. X, fig. 4).—General *colour* almost uniform dark brown—nearly black. *Length* up to



a *b*

Fig. 16.—*Blatta orientalis* Linnæus. *a*, male; *b*, female (× abt. 1·5).

about 25 mm. *Antennæ* about as long as the body, second and third segments about equal. *Elytra* dark brown, covering some two-thirds of the abdomen, somewhat truncate at the apex. *Wings* equalling the elytra in length, anterior part brown, posterior hyaline; *legs* somewhat paler than the general colour, well armed with spines. *Supra-anal plate* of abdomen nearly straight, posterior margin paler. *Styles* present.

Female Imago (Pl. X, fig. 3).—General *colour*

and *length* much as in the male; *abdomen* broader. *Elytra* in the form of short lobes, but possessing veins. *Wings* rudimentary. *Supra-anal plate* deeply notched. *Oötheca* with dorsal suture. Third segment of *antennæ* longer than the second.

Oötheca (fig. 13, nos. 2 and 3).—In *B. orientalis* the dark brown swollen oötheca, with dorsal suture, measures about 12 mm. by 6 mm., and contains two rows of eight eggs each, carefully fitted to economise space. It is carried for a time (as to how long opinions differ) protruding in an upward curve from the extremity of the abdomen. One observer gives 12 hours only as the period during which it is carried; but probably the usual period is a longer one than this. The time which elapses before hatching occurs is apparently a variable one also. It has been recorded that this period extends to twelve months; but Brindley, in the course of experiments made in 1897, found that "all cases that hatched did so within a few days after deposition." Although it might at first appear so, this subject is not easy of investigation.

Nymph.—It is very difficult, as Brindley found, to rear cockroaches from the egg in captivity, and it would seem that only a small percentage of eggs hatch from the oöthecæ, that are placed in a position selected by the parent insect. According to Westwood the embryos, when ready to emerge, eject a kind of saliva from their mouth, with which to soften the oötheca along its serrated edge, and so make emergence easy. On escaping the nymphs are white and wingless; otherwise they are miniatures of their parents. It is not quite certain whether or not a moult immediately occurs; one takes place about a month later, and another at the end of the first year. Further moults occur at the end of each year, till, after six or seven, the nymph becomes an image. Growth, therefore, is slow. Wing-rudiments are present during the last two or three stadia. When the time for the final

change occurs, the skin cracks along the back of the thorax, and the imago slowly and carefully draws itself out. As after each moult (ecdysis), it is at first white, but in about three days it attains its full colour. The nymph, which in appearance closely resembles the female imago, is, like her, almost black in colour.

Date.—Living under artificial conditions of warmth and protection, *B. orientalis* is probably continuous-brooded, though it is of course possible that inherited habits may keep it to its natural breeding season.

Habits, etc.—Coming no doubt from a warmer climate than our own, the common cockroach seeks out spots for a habitation where a genial temperature is fairly continuous. Hence its predilection for kitchens, bakehouses, Zoological Gardens, etc., where, in addition to the warmth, food is easily procurable. It is an omnivorous feeder, scarcely anything coming amiss—ink, blacking, the film on photographic plates, its dead companions, cast-skins, and empty oöthecæ. Cucumber, we are told, disagrees with it, and, according to some, phosphorus-paste is fatal. If *B. orientalis* gets access to human food it spoils more than it eats, owing to the unpleasant odour left behind it. In its habits it is nocturnal, hiding in narrow crevices during the day, its flattened build specially fitting it for so hiding. Still the cockroach has some compensating points—it is a useful scavenger, and an enemy of the bed-bug. We have been told that it has been employed in medicine, and that it even has a pleasant taste; but its great use is in the biological laboratory. There great numbers are dissected; for *B. orientalis* is readily obtainable and at the same time serves admirably as the type of an insect in a fairly unspecialised state.

Though it has been taken out of doors occasionally, there seems to be little, or no, tendency towards acclimatisation in Britain. On very warm nights it no doubt often comes out into the open air; but it has once or twice been met with farther afield than this.

Chitty found it in woods near Barnet (Herts). On 29 March 1907 W. Daws took a female in a garden (presumably at Mansfield, Notts) at a distance from any house in a heap of garden refuse: it was very stupefied and did not attempt to escape. Morley found two specimens on 9 January 1896, hibernating beneath the bark of a large elm-tree at Ewell, near Epsom, but he had never heard of any other "wild" catch: there was a cottage about a hundred yards away, but no other houses were in the vicinity. On 31 January 1911 Burr found this cockroach, along with *Blattella germanica*, within a rubbish-heap in a brick-yard near Cheriton in Kent (see p. 90). In the Hope Collection at Oxford there is a female nymph, labelled "under bark of tree 10 feet up, K.G." [perhaps "Kew Gardens"] (*Burr*).

Distribution.—In *B. orientalis* we have a cosmopolitan species, which is now found practically everywhere. It had in fact become such a wanderer that its original home was uncertain. Linnæus says: "Habitat in America, hospitatur in Oriente." (It is a native of America, but has taken up its abode in the East.) Further he says: "Hodie in Russiæ adjacentibus regionibus frequens; incepit nuperis temporibus Holmiæ, 1739, uti dudum in Finlandia." (Common at the present day in parts near Russia, it has lately, 1739, reached Stockholm, and but just appeared in Finland.) He is mistaken with regard to America, for *B. orientalis* is a native of the Old World, and, so far as Britain is concerned, does not belie its scientific name. Perhaps its original habitat has at last been discovered, for Shelford says (referring to 'Ann. Mus. Zool. St. Pétersbourg' xii (1907) p. 401): "Curiously enough it has not been met with in a truly wild state until quite recently; the first specimens that were found were caught in houses, and though it has always been assumed that it was imported into Europe from the East, I am not aware that it has ever been found in Asia except as an

unwelcome guest in human habitations. The discovery of specimens in the Crimean peninsula living under dead leaves, vegetable detritus and stones, in woods and copses far from any human habitation, is a fact of considerable interest, and it is perhaps permissible now to regard Southern Russia as the centre whence this ubiquitous insect has spread."* This in itself does not constitute a proof that the original home of *B. orientalis* has been discovered, for but nineteen specimens in all were examined; but there is a very fair probability that such is the case; all the same, though it has now spread practically all over the world, it still inhabits principally Asia and Europe—almost always, it would seem, living indoors under artificial conditions.

Distribution in Britain.

Following the trade routes *B. orientalis* made its way to Holland and England in the reign of Elizabeth. Early in the seventeenth century Swammerdam knew it as an inhabitant of Holland, and spoke of it as: "*Insectum illud Indicum, sub nomine Kakkerlak satis notum*"—the Indian insect well known as Kakkerlak. In 1624 Moufet, in his 'Insectorum Theatrum,' speaks of its occurrence in wine-cellars, etc., in England. It seems to have spread here slowly, for Gilbert White, in 1790, speaks of it as an unusual insect at Selborne. By 1829 it was established at Derby. It is possible that it may not yet have reached some northern and western villages. It has, however, been observed in the Scilly Isles, in the Isle of Man, and in the Orkneys.

In Sibbald's "Historia Animalium in Scotia" ('Scotia Illustrata,' 1684) we find, Blatta, the *Moth-fly*, which is presumably *B. orientalis*. In a "List of Insects found in the neighbourhood of Edinburgh" by C. Stewart, published in the 'Memoirs of the Wernerian Nat. Hist. Soc.' for 1809, vol. i, p. 572, occurs *Blatta orientalis*. In G. Don's "Account of the Plants and Animals of the County of Forfar" (Headrick's 'View of the Agriculture of Angus, or Forfarshire,' 1813, Appendix, p. 50) we read: "*Blatta orientalis* found in some of the bakehouses in the seaport towns."

* 'A Naturalist in Borneo,' p. 115, 1916.

Evans* speaks of it as—"Common in kitchens, bakehouses, etc. in most towns. I have found it occasionally even in isolated farmhouses, and Mr. R. Godfrey tells me cockroaches, no doubt of this species, are common in coal-pits about Bo'ness. I also heard of their presence in a coal-pit near Dalkeith a number of years ago." It is reported from Paisley (*A. M. Stewart*), and as abundant in houses, etc., in the Ellangowan district of Dumfries (*B. McGowan*). In Ireland it has occurred in Dublin, Donegal, and Armagh (*fide S. W. Kemp*), etc. Probably *B. orientalis* is dominant over *B. germanica* and *P. americana*, although it has been thought that *B. germanica* is displacing it in Vienna. In Kew Gardens it seems to be less common than *P. australasiæ*.

Genus 4. **PERIPLANETA** Burm.

Periplaneta Burmeister Handb. Ent. vol. ii, p. 502 . . . 1838.
Cacerlaca Saussure Mém. Hist. Nat. Mexique. Blatt., p. 71 . 1864.
Blatta auctorum.

Sexes very similar; antennæ slender, longer than the body. Pronotum with margins convex, lateral ones deflexed and approaching anteriorly, so that the front margin is narrow, pronotum not covering the back of the head, widest beyond the middle. Elytra and wings usually extending considerably beyond the tip of the abdomen. Legs strongly spined, spines on tibiæ arranged in three rows; basal segment of hind tarsi as long as, or longer than, the remaining segments together; the whole tarsus spined beneath; pulvilli very small. Cerci and styles long. Type of the genus *Periplaneta americana* Linn.

Table of Species.

1. Elytra unicolorous; pronotum bright brown, clouded; cerci of male long, curved after death, rather light in colour . . . *americana*.
2. Elytra with a yellow streak in the mediastinal area; pronotum dark with a yellow border; cerci straight, darker . . . . *australasiæ*.

* 'Ann. Scott. Nat. Hist.' Jan. 1901.

1. **Periplaneta americana** Linn.

(Plate VI, figs. 3–6; Pl. VII, fig. 6; Pl. IX, fig. 1; Pl. XI, fig. 1.)

americana	Linn. Syst. Nat. (ed. x), vol. i, p. 424, n. 4	1758—*Blatta.*
,,	Serv. Ann. Sci. Nat. xxii, p. 39 .	1831—*Kakerlac.*
,,	Burm. Handb. Ent. vol. ii, p. 503 .	1838—*Periplaneta.*
,,	Brunner Nouv. Syst. Blatt. p. 232, pl. v, f. 24	1865—*Periplaneta.*
,,	Brunner Prod. der Eur. Orth. p. 50, pl. i, f. 11	1882—*Periplaneta.*
,,	Eland Shaw Syn. Brit. Orth. in Ent. Mo. Mag. p. 371, f. 2 . .	1889—*Periplaneta.*
,,	Finot Faune de la Fr.. Orth. p. 83 .	1889—*Periplaneta.*
,,	Burr Brit. Orth. p. 26, pl. ii. f. 6 .	1897—*Periplaneta.*
Americana	Kirby Syn. Cat. Orth. i, p. 140 .	1904—*Periplaneta.*
americana	Shelford Gen. Ins. Fasc. 109. p. 18	1910—*Periplaneta.*
,,	Burr Syn. Orth. W. Eur. p. 17 .	1910—*Periplaneta.*
,,	Lucas Proc. S. Lond. Ent. Soc. p. 37, pl. iii, f. 6, 6 a . . .	1915—*Periplaneta.*

(Other synonyms are: *B. kakkerlac* De Geer; *B. aurelianensis* Fourcroy; *B. siccifolia* Stoll; *B. aurantiaca* Stoll; *P. stolida* Walker.)

Original Description.

americana, 4. B. ferruginea, thoracis clypeo postice exalbido.
Habitat in America.
Major B. orientali, sed simillima. Elytra *Alæque corpore longiores.* Antennæ *longæ.*
(C. Linnæus, 'Syst. Nat.' tom. i, p. 424, 1758.)

Male Imago (Pl. IX, fig. 1).—General *colour* bright sienna-brown. *Length* about 35 mm. *Antennæ* much longer than the body. *Pronotum* mottled, in a ring within the margin, with lighter brown. *Elytra* somewhat pointed at the tip; *elytra* and *wings* (fig. 15) both longer than the abdomen. *Legs* bright brown, heavily spined. *Supra-anal plate* notched, pellucid. *Cerci* long, tapering, curved after death. *Styles* long.

Female Imago (Pl. XI, fig. 1).—*Colour* and *size* much as in the male. *Wings*, in this sex also, longer than the body. *Elytra* slightly truncate at the tip. *Abdomen* broader. *Cerci* more straight and less tapering. *Supra-anal plate* brown, not pellucid.

Oötheca (fig. 13, no. 4).—Dark brown, with suture dorsal. Those which I possess apparently contain at

the most 14 eggs—one seems to have only ten. Nevertheless it may be correct that the normal number is 16. In shape the oötheca closely resembles that of *B. orientalis*, but is perhaps a little more rectangular.*

Nymph.—Rather uniform rich sienna-brown, mottled with a lighter tint on the dorsal surface of the thorax. Abdomen darker, legs paler. Cerci straight, lanceolate, dark.

Variation.—*P. americana* is subject to a little variation in size; otherwise it is fairly constant, except in the mottling of the pronotum. Here the paler tint is sometimes greater in extent and more sharply defined, giving somewhat the appearance of the pronotum of *P. australasiæ*. Brunner mentions "varietas pronoti disco toto pallido."

Date.—No doubt the same should be said of this species (and of *P. australasiæ* and *L. surinamensis*) as of *B. orientalis* (p. 97). A *P. americana* was, however, found at Liverpool Docks, with its oötheca protruding, on 30 December 1904.

Habits, etc.—*P. americana* is the largest of the cockroaches that breed in Britain. Apparently there is no likelihood of its being acclimatised out-of-doors, but the list of its adopted haunts under artificial conditions is a long one:—houses, breweries, bakehouses, warehouses, docks, sugar-refineries, rubber and dye works, nurseries, hothouses, Zoological Gardens, etc. On 23 October 1910 a good number (taken to be this species) were seen in the old insect-house at the Zoological Gardens. They were continually emerging from the grating over the hot-water pipes, and ate readily some sugar put down for them. Previously, on 22 May 1907, in the insect-house this cockroach was noticed to be quite at home in a free state, and apparently its presence

* I have oöthecæ of *Ectobius* and *Blattella*, which look as if they had been deposited in an unfinished state, and so under unnatural conditions. Perhaps this may sometimes help to explain the varying time of carrying the oötheca and the varying interval that elapses before hatching.

there was well known to the sparrows, for while we were watching a sparrow carried away a specimen from before us. Possibly the same thing had occurred before, as several wings and other remains were noticed near, the feast apparently having taken place on the spot when the house was free of visitors. In 1897 Bell-Marley found them at the Junior U.S. Club in London, in the cellars. He could hear the rustling of their wings as they hurried away, and he saw many in the act of flying. F. W. Edwards had some specimens sent to him from a coalmine in Monmouthshire, where they were known to have been present for some years. Bignell speaks of *P. americana* as driving out *B. orientalis* at Plymouth; while, on the other hand, Carter told Burr that it was once common at Bradford, but that it had disappeared and been replaced by *B. germanica* and *B. orientalis*. From its being so great a pest on board many ships, it is often spoken of as the "ship-cockroach." As regards food it seems to be practically omnivorous.

Distribution. — According to Brunner, "Cette Blattaire se rencontre dans le monde entier": it is in fact a cosmopolitan species. In England it is numerous at the Zoological Gardens, in docks, warehouses, etc. In Europe it is abundant under similar conditions. Finot says that in France it is found in ports, vessels, shops of colonial produce, sugar-refineries, and hothouses: it is naturalised only in certain ports of the Mediterranean coast. Though Walsh doubts if *P. americana* is really indigenous to America but suspects its importation from Asia, it does appear to hail from South America and has followed the trade-routes over nearly all the world. In Honolulu it often flies during the day.* In Cairo it was found indoors (F. W. Sowerby).

* "It is probably the species of which Captain John Smith, of Virginia fame, wrote in 1624—'a certaine India Bug, called by the Spaniards a Cacarootch, the which creeping into Chests they eat and defile with their ill-scented dung'" (Shelford, 'A Naturalist in Borneo,' p. 115 (1916).

Distribution in Britain.

Perhaps the earliest reference we have to *P. americana* as British is Stephen's statement in his 'Illustrations' as to its being frequently taken in London previous to 1835. It was first recorded from Burton in 1842 (*Jourdain*) and in 1869 had inhabited the breweries there for some years (*Brown*). From the following localities at least it has also been recorded; but it is not always certain whether the references are to casuals or colonists:—

England.—*Cambridge:* (*Sopp*). *Derbyshire:* Burton, breweries (*Brown*); occasionally in Derby (*Pullen*). *Devon:* (About twelve years since (*in litt.* 1903) Bignell observed a great number in the streets of Plymouth, evidently having flown from a ship then in Great Western Dock. Since that time they have established themselves in several bakehouses in Plymouth (*Bignell*).) Common in Plymouth in houses, bakehouses, etc. (*Bracken* 1913). *Gloucestershire:* (*Edwards*). *Kent:* Dover (*Burr*). *Lancashire:* Leyland near Preston in rubber-works (*Charnley*); Liverpool docks (*C. W. Dale* 1886, *Charnley* 1904); Manchester—in rubber-, dye-, and sugar-works (*Chappell*), from a brewery yard in Feb. and June 1903 (*Sopp*), Ancoats, one (*Crabtree*), in Princess Street (*Nathan*). *London:* Zoological Gardens (*Lucas*); about two dozen, taken April 1916, in a warehouse in the City, amongst bales of rush baskets from Japan (*Moore*); Covent Garden, two, 20 Feb. 1897 (*Bell-Marley*, who did not think them established there); Silvertown, thoroughly established in a sugar refinery (*Lucas*); warehouses near the Thames, Red Lion, and Bloomsbury Square (*H. C. R.* 'Science Gossip,' 1868); Junior U.S. Club cellars 1897, established (*Bell-Marley*). *Middlesex:* Forty Hill, Enfield, nymphs and imagines, 20 March 1907 (*Edelsten*); Chiswick, Royal Horticultural Society's Gardens, 7 November 1896, a fine specimen (*Wright*). *Monmouthshire:* a coal-mine at Pontnewydd, established (*Edwards*). *Norfolk:* (*Edwards*). *Notts:* Worksop, casual, 20 Mar. 1902 (*Eland Shaw*); Mansfield, male and female, 19 Feb. 1906 (*Daws*). *Surrey:* Kew Gardens—a large one found in the tropical propagating pits, April 1897; one imago and three nymphs found alive in a case received, 18 October 1898, from the Belgian Congo State; four fine specimens found in a case of plants from Singapore, June 1899; and two imagines in a package from Burma, March 1900. This species, which has established itself at the Zoological Gardens in Regent's Park, does not seem to have done so at present in Kew Gardens—or at any rate not to the same

extent as *P. australasiæ*. *Yorkshire :* Goole (*Burr*) ; Keighley (*Butterfield*) ; Bradford and Huddersfield (*Porritt*).

Wales.—*Glamorgan :* Swansea, brought to H. R. Wakefield on 4 Jan. 1917 from Pentre Pit (depth not known) ; the colliers call them "pit beetles" ; they are abundant in the colliery workings.

Scotland.—"The only place in which I have met with this large species, to which the name of "Ship Cockroach" has been applied, is in the palm house of the Royal Botanic Garden in Edinburgh, where, in July 1879, I obtained several. One which I still possess has been shown to Mr. Burr, who confirms my identification. I have heard of its occurrence elsewhere in Edinburgh or Leith." (W. Evans, 'Ann. Scott. Nat. Hist.' Jan. 1901.) [Apparently they have since disappeared from the Gardens.]

Ireland.—*Belfast :* (*fide Kemp*). *Dublin :* abundant in a soap factory (*Carpenter*).

2. **Periplaneta australasiæ** Fabr.

(Plate VII, fig. 7 ; Pl. IX, fig. 2 ; Pl. XI, fig. 2 ; and figs. 11 and 17 in text.)

australasiæ	Fabr. Syst. Ent. p. 271, n. 5 . .	1775—*Blatta.*
„	Burm. Handb. Ent. ii, p. 503, n. 4 .	1838—*Periplaneta.*
„	Brunner Nouv. Syst. Blatt. p. 233, n. 11	1865—*Periplaneta.*
„	Eland Shaw Syn. Brit. Orth. in Ent. Mo. Mag. p. 371	1889—*Periplaneta.*
„	Burr Brit. Orth. p. 26, pl. ii, f. 7 .	1897—*Periplaneta.*
Australasiæ	Kirby Syn. Cat. Orth. i, p. 141. .	1904—*Periplaneta.*
australasiæ	Mangan Mth. pts. of some Blattidæ (Proc. Roy. Irish. Acad.) pls. i–iii .	1908—*Periplaneta.*
„	Burr Syn. Orth. W. Eur. p. 17 .	1910—*Periplaneta.*
„	Shelford Gen. Ins. Fasc. 109, p. 18	1910—*Periplaneta.*
„	Lucas Proc. S. Lond. Ent. Soc. p. 37, pl. ii, ff. 7, 7 a	1915—*Periplaneta.*
„	Shelford Nat. in Borneo, p. 115 et. seqq.	1916—*Periplaneta.*

(Other synonyms are : *B. domingensis* Beauvois ; *P. zonata* de Haan ; *P. repanda* Walker ; *P. subcincta* Walk. ; *P. inclusa* Walk. ; *P. emittens* Walk. ; *Polyzosteria subornata* Walk. (nymph).)

Original Description.

Blatta australasiæ.

5. B. ferruginea, thorace atro ; annulo albo, elytris basi lineola alba. Capta frequens in nave e mari pacifico et regionibus incognitis revertente.

Magnitudo et statura B. americanæ. Caput atrum, margine baseos albo. Thorax ater, nitens, annulo magno albo. Margo tamen omnis ater. Elytra ferruginea, striata, linea longitudinali alba ad marginem exteriorem baseos.
(J. C. Fabricius, 'Syst. Ent.' p. 271. 1775.)

Male Imago (Pl. IX, fig. 2).—General *colour* rich sienna-brown. *Length* some 27 mm. *Head* with a yellow ring round the insertion of the antennæ, and a great part of the face yellowish-brown; *antennæ* exceeding the body in length. *Pronotum* with a bright, distinct, yellow ring within the margin, broader posteriorly; disc and margin of pronotum dark. *Elytra* with the mediastinal area yellow, reaching (as well as

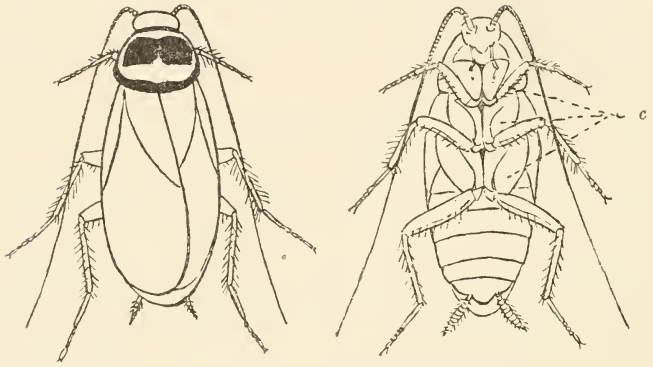


Fig. 17.—*Periplaneta australasiæ* Fabricius. Dorsal and ventral aspect (× 1·5). *c*, coxæ.

the wings) beyond the tip of the abdomen. *Legs* (fig. 11) with the femora somewhat paler, strongly spined. *Supra-anal plate* notched. *Cerci* rather dark brown, lanceolate, nearly straight.

Female Imago (fig. 17).—Female closely resembling the male; but slightly darker, a little broader and less graceful in outline, wing-tips slightly less pointed, and the supra-anal plate notched and strongly arched.

Nymph.—Sienna-brown, rather prettily mottled and spotted with lighter brown. (A very small one, about 3 mm. long (which I take to be this species) has two transverse whitish bands, one behind the pronotum and the other across the abdomen.)

Variation.—Size and general colouring are fairly constant. The arrangement and relative proportions of the two colours on the pronotum vary somewhat, and the yellow ring is sometimes nearly obsolete. A specimen from the *Victoria regia* House in Kew Gardens had the yellow ring of the pronotum reduced to a thin band anteriorly and a three-pointed spot behind: the face also was dark in colour.

Date.—No doubt the same may be said of this species as of *Blatta orientalis* on p. 97.

Habits, etc.—Some cockroaches that are domiciled with us act the part of scavengers to a great extent, and, though obnoxious in many ways, probably do very little real damage. Apparently, however, this cannot be said of *P. australasiæ*; the reports of damage done by it are too frequent and definite.* Apart from a considerable number of casual examples which are from time to time reported as arriving here, this cockroach is often found established in orchid and other glasshouses, in Botanic Gardens, in the Zoological Gardens, and in similar places. On 12 January 1914 in the warm tortoise-house in the Zoological Gardens, Regent's Park, some imagines of *P. australasiæ* were seen. One, apparently hurt, wriggled on its back down to the water. After a time a Painted Terrapin (*Chrysemys picta*) of North America caught and ate it. No doubt in such a locality the conditions of existence are very favourable to it. Apparently the same may be said of Kew Gardens, where it is strongly established: it appears to be the most abundant of the cockroaches found there. I had several times received consignments from the Gardens, and on 10 April 1897 I paid a visit to examine it in its adopted home. We went first to one of the very hot forcing-pits, where some were generally to be found, but did not see any. Specimens that had been previously captured and

* Shelford found it a serious museum-pest in Sarawak ('A Naturalist in Borneo,' p. 116).

were in a box were very lively, no doubt owing to the very warm atmosphere. We then went to the Palm House, where a large number of very lively individuals were found; two only, however, were imagines—most were very small. They were chiefly to be met with on palms, bananas, and so forth, hiding amongst the dead leaves, etc., on the stems and trunks. Phosphorus-paste had been freely used to mitigate the nuisance, and it was thought with some effect.

Of *P. australasiæ* at Kew, W. Watson wrote in the 'Bulletin': "Their haunts are dry holes and corners about the stages and hot-water pipes, the sheathing-bases of palm, banana, and pandanus leaves, and among the crocks in large plant-pots and tubs. They are in hiding during the day, but at night they come out and run or fly about among the plants, devouring flowers and leaves like rabbits. Such plants as *Eucharis*, *Crinum*, and *Alpinia*, when in flower, have little chance in the palm house, where the cockroaches are most abundant; they also find out the ripening bananas and soon devour them. They are as clever as mice in scenting food and more clever in learning what to avoid in the shape of a trap or poison. Jars with a little treacle at the bottom will trap them for a few weeks, then the bait must be changed to beer, linseed-oil, or sugar and water, otherwise the cockroaches cease to be attracted. . . . We have caught as many as 400 in one night in the palm house, and as they appear to be vegetarians as a rule and to eat a great deal of food it will be seen how troublesome they may become in large plant-houses. In the smaller houses they give less trouble, because they can be more easily kept down. They breed very rapidly and the young start foraging very early." ('Wild Fauna and Flora of Kew Gardens,' vi.)

Distribution.—It seems quite clear that *australasiæ* is a misnomer. Shelford thinks it an infrequent immigrant only into Australia, and that its real home

may be South-eastern Asia or tropical Africa. It is now a cosmopolitan species. It is established in Britain and other parts of Europe, while it is recorded from Madeira, St. Thomas, Batavia, Columbia, Padang, Florida, Central America, and Brazil at least.

Distribution in Britain.

Occurrences of this cockroach, which have come under my notice, are fairly numerous; but, as with *P. americana*, it is not always clear whether the references are to residents or casuals. Early in 1886 McLachlan received for identification several examples of *P. australasiæ* which had been found, probably in a warehouse, at Belfast.* Although it had already been noticed as occurring in several continental ports, this was thought to be its first appearance as a British insect. There are, however, specimens in one of Westwood's "Economic Cabinets" in the Hope Museum at Oxford. One of these is described as, "destroying orchids end of August 1865"; and the other as, "doing mischief in orchid-house in 1871." C. W. Dale could carry the record even farther back, for he says†: "There appears to be a mistaken idea in the minds of some entomologists that these [*P. australasiæ* and *P. americana*, etc.] are recent additions to the British fauna. This is not so, for I have specimens of the former taken in a grocer's shop at Sherborne as long ago as 1839, but which have stood in my collection as representatives of the latter." In the "Dale Collection," now in Oxford, two examples—an imago and a nymph—judging by the labels, are the specimens referred to. I first made acquaintance with this species as a British insect on 20 April 1895 when Mrs. W. D. Drury gave me a specimen which she took out in the open on that date in Kew Gardens. Records so far received or noticed are:

England.—*Cambridgeshire:* Cambridge, Botanic Gardens, flourishing in 1893 (*D. Sharp*). *Cornwall:* Truro, one, May 1906 (*Rollaston*). *Derbyshire:* Accidentally imported with plants from Queensland, and first noticed at Calke Abbey, in 1897; now a resident, breeding in one of the outhouses (*Harpur-Crewe, fide Jourdain*, 1905); Buxton, 1904 (*Sopp*). *Dorset:* Sherborne (*C. W. Dale*). *Gloucestershire:* (*Edwards*). *Hants:* Brockenhurst, 1906, a nymph amongst bananas (*W. E. Sharp*); Bishop's Waltham, at Swanmore Park Gardens,

* 'Ent. Mo. Mag.' 1887, p. 235.
† 'Entomologist,' 1896, p. 164.

established and numerous (*Molyneux*). *Lancashire:* Liverpool Docks, from a cargo of linseed (*Hardy*); Wavertree, from hot-houses, where the insects are believed to nibble the aërial roots of orchids (*Harrison*); Worsley, naturalised (*Stott*), whence they have been received in all stages of growth during the past few years [1905] (*Sopp*). *Lincolnshire:* Louth, one female, 1902 (*Carter*). *London:* Zoological Gardens (*Lucas*); Brixton (*Taylor*). *Middlesex:* Orchid-house at Potter's Bar (*Bedwell*). *Notts:* Mansfield, a male, 14 February 1907 (*Daws*); Wiseton Hall, numerous in glass-houses, 1902 (*Shaw*). *Suffolk:* Occasionally imported to Ipswich in linseed, etc. (*Morley*). *Surrey:* Orchid-house, Camberwell, 1899 (*Lucas*); Kew Gardens—Apart from those bred in the Gardens, a number have arrived in cases from abroad: a nymph found on living plants from Ootacamund in India, 3 April 1897; two in a box from Dominica about April 1897; a nymph, received July 1898, in a case from Buitenzorg, Java; a nymph, received April 1901, in a Wardian case from Calcutta; a nymph, amongst *Catasetum longifolium* from Demerara, about April 1897; one imago from pit A, about April 1897; one imago and two nymphs, received 18 October 1898, in a case from the Belgian Congo State (*Lucas*, 'Kew Bulletin,' Addl. Series, v, 1906). *Sussex:* Preston near Brighton, one (*Morris*). *Yorkshire:* Barnsley, one in bananas (*Bayford*); Keighley, 1914 (*Porritt*); Bradford district (*Carter*); abundant, 1898, in a greenhouse at Shibden, Halifax (*Porritt*).

Wales.—*Glamorgan:* Brought 29 Jan. 1917 to H. R. Wakefield, Swansea, by the Spanish Consul, who said that these cockroaches had played havoc with his orchids, more especially the Cattleyias and Vandas. As new growth makes its appearance it is immediately devoured by these unwelcome visitors. Probably they came over with some S. American orchids.

Scotland.—*Edinburghshire:* "Wishing to know if *P. americana* was still present at the Edinburgh Botanic Garden, I wrote to Dr. R. Stewart MacDougall, and have received from him the following interesting information: 'The Cockroach at the Garden for the last few years is *P. australasiæ*. When I have desired Cockroaches, and they have been trapped for me, this is the one we always get' (*in litt*, 5 December 1900). It would thus appear that *P. americana* has been ousted by this form" (*Evans*, Jan. 1901). *Perthshire:* In an orchid-house at Fargandenny, where it had been observed for three years, and had caused a deal of damage (*Wainwright*). *Renfrew-*

shire : One, alive, out of a cluster of bananas from the Canary Islands, in a fruiterer's shop at Paisley, about the end of 1900 (*Stewart*).

Ireland.—*Armagh :* Belfast (*McLachlan*). *Dublin :* Dublin, greenhouses in the Botanic Gardens (*Halbert*).

Genus 5. **LEUCOPHÆA** Brunner.

Leucophæa Brunner Nouv. Syst. Blatt. p. 278 . . . . 1865.
Pycnoscelus Scudder Boston Journ. Nat. Hist. vii, p. 424, nymph 1862.

(λευκοφαιος = fuscus.)

This name was introduced by Brunner in his 'Nouveau Système des Blattaires' in 1865, as a sub-genus of *Panchlora* Burm., to contain those insects with "Color fuscus vel testaceus," p. 272. He placed in the sub-genus *P. surinamensis* Linn., *P. nigra* Brunn., *P. pœcila* Schaum., and *P. maderæ* Fabr. Later he restricted the sub-genus to *L. surinamensis* and *L. niger*. The name *Pycnoscelus* was created for a genus in which to place *P. obscurus*, which Scudder thought new, but which was really the nymph of *L. surinamensis*. Type of the genus, *Leucophæa surinamensis* Linn.

1. **Leucophæa surinamensis** Linn.

(Plate VII, fig. 8; Pl. X, figs. 1 and 2; Pl. XI, fig. 3.)

surinamensis Linn. Syst. Nat. (ed. x) i, p. 424, n. 3 . . . . . 1758—*Blatta*.
„ Brunner Nouv. Syst. Blatt. p. 278, n. 12, pl. 7, f. 32 a–e . . . 1865—*Panchlora*.
„ Burr Brit. Orth. p. 28, pl. 2a, f. 2 . 1897—*Leucophæa*.
„ Kirby, Syn. Cat. Orth. i, p. 151 . 1904—*Leucophæa*.
„ Lucas Proc. S. Lond. Ent. Soc. p. 38, figs. 8. 8a, 8b . . . 1915—*Leucophæa*.

[Other synonyms are: *Blatta melanocephala* Stoll; *B. indica* Fabricius; *B. punctata* Esch.; *B. corticum* Serv.; *Panchlora submarginata* Walker; *P. occipitalis* Walk.; *P. celebesa* Walk.; *Pycnoscelus obscurus* Scudder (nymph).]

(*B. indica* of Fabricius is a small form (which some still consider distinct) with abbreviated elytra).

Original Description.

surinamensis. 3. B. livida, thoracis margine antico albo.
Habitat Surinami.
(C. Linnæus, 'Syst. Nat.' ed. x, tom. i, p. 424, 1758.)

Male Imago (Pl. XI, fig. 3).—General *colour* dark brown. *Length* some 20 mm. *Head* black; mouth-parts yellowish; a yellow ring round the insertion of the *antennæ*, which are rather short. *Pronotum* black and shining, with a pale yellowish anterior margin. *Elytra* fully developed, yellow-brown, with a pale streak in the mediastinal area and a dark streak anterior to it near the base of the elytron. *Wings* fully developed, anterior part similar in appearance to the elytra, the remainder slightly smoky. *Legs* yellow-brown, heavily spined. *Abdomen* dark above, sometimes ornamented a little with marginal yellowish spots; below, to a great extent of a deep russet tint. *Cerci* very short, triangular.

Female Imago.—Closely resembling the male as the colour is the same, and elytra and wings are fully developed, although the elytra are usually perhaps rather shorter than in the male. The length in this sex may be usually rather greater.

Nymph (Pl. X, fig. 2).—Very dark above, chiefly russet below; legs yellow-brown. A large specimen had two transverse dorsal yellowish bands (connected at their extremities) on the abdomen near the base, and a single one near the apex. Brunner* thus describes the nymph:—"La larve est d'une forme ovale très-prononcée, en ce que son abdomen est beaucoup plus large que le pronotum. Toute sa surface est brun foncé et tous les bords sont finement liserés d'un brun un peu plus clair; la band testacée du bord antérieur du pronotum, que l'on observe dans les individus adultes, est effacée. Toute sa surface est luisante, à l'exception des cinq derniers ségments dorsaux de l'abdomen, qui sont opaques et couverts de points élevés. Cette difference de texture donne à cette larve un aspect particulier."

Oötheca.—I have not myself met with a specimen of the oötheca of this cockroach, but Brunner* thus

* 'Nouveau Système de Blattaires,' p. 278 (1865).

describes it:—"La coque a la forme d'un cylindre comprimé, très-long; les quinze compartiments des deux côtés y sont fortement indiqués extérieurement par des stries enfoncées. La suture est lisse et l'on remarque que les compartiments des deux côtés se joignent à la suture en ordre alternant, de sorte que le compartiment de l'un des côtés se case toujours dans l'angle formé par deux compartiments du côté opposé; la ligne de jonction va par conséquent en zig-zag. L'oviscapte est couché horizontalement dans le dernier ségment de la femelle. Ses dimensions sont: longueur 8 mm., hauteur 2·8 mm., largeur 1·8 mm."

Variation.—So far as my own experience goes *L. surinamensis* varies little in colour and general appearance, but may do so considerably in size. An imago received from Kew Gardens, 29 September 1909, measured only 16 mm. in length. Sopp has one measuring but 15 mm., while another in his possession measures 24 mm. Tarsal segments are sometimes reduced to four.

Date.—As this cockroach is found only under artificial conditions in Britain, no doubt the same must be said of its breeding habits as of those of *B. orientalis* (vide p. 97).

Distribution.—*L. surinamensis* is now a cosmopolitan species, having spread, through the influence of trade, from its tropical home to many other parts of the globe. It has been noted from Britain, France, Spain, Burmah, Amoy, India, Java, Philippines, China, Senegal, Cayenne, Martinique, Central America, Brazil, Mexico, United States, British Columbia, Honolulu,* and no doubt several other places.

Habits and British Localities.

This cockroach seems to have been first recorded for Britain by Burr,† Guermonprez having sent him one of two taken

* De Bormans says it is found in Honolulu under stones; but it is not very common, the males being very rare.

† 'Ent. Mo. Mag.' 2nd series, viii, p. 14.

in a house at Bognor, Sussex, and supposed to have been imported from Madeira in bananas. One would gather from this that the date of first appearance of *L. surinamensis* in Britain was just prior to 1897. Reference, however, to Professor Westwood's "Economic Cabinets" in the Hope Museum at Oxford carries the date back at least to 1868. Specimens there are credited with eating plants and stove fruits in house (April, 1868) and destroying orchids (March, 1869). In Westwood's Economic Collection there are also some undated specimens accompanied by the following interesting letter :—

GENTLEMEN,

I herewith enclose for your inspection two species of Beetles which are most pernicious to Pines.

They first attack them when in bloom, gnawing the flowers to such an extent that causes great deformity in the Fruit, which, when commenced ripening, they burrow holes in, so that frequently before the fruit is quite colored the better half of it is consumed.

I have been battling with these pests for the last five years, and trying to exterminate them but, am sorry to say, the more I fight the stronger they seem to get, as they breed at a most inconceivable rate in the plunging material which is composed of tan and leaves.

I have employed Phosphorus but to no purpose, and latterly have laid traps for them in the following manner.

I get a lot of three inch pots and place in each a slice of carrot—then half fill the pots with moulded [? mouldy] hay and place them between the pines—then at night go round with a pail of hot water and pour the contents of each trap into it, and have in this manner destroyed tens of thousands—and yet at this moment the plunging material is literally *alive* with them.

Would you kindly give me the names of the species as I have never met with such before, and also advise what means I can adopt for getting rid of such formidable pests.

I am, Gentlemen,
Your obed$^{t.}$ serv$^{t.}$
R. W.

[Sent to the Editors of the 'Gardener's Chronicle,' who presumably sent it on to Professor Westwood. At the meeting of the Entomological Society of London on 5 April 1869 Westwood exhibited *Blatta melanocephala* (presumably = *L. surinamensis*) as having been found destructive in orchid-houses in this country. No doubt the exhibit consisted of some of the examples at present in his Economic Collection.]

In 1897 (15 Apr.) I received two—an imago and a nymph—taken in the tropical propagating pits in Kew Gardens, and in 1898 (9 June) I received another nymph from Kew, found in cocoa-nut fibre in one of the tropical houses. Nymphs cannot always be identified with absolute certainty but there appeared to be no doubt in these cases. No further notices of the insect appeared for a few years, but on 17 October 1904 it was exhibited at the meeting of the Lancashire and Cheshire Entomological Society. Four insects, it appears,

had been captured amongst peats at Fallowfield, Manchester. These were sent to Sopp by Dr. W. E. Hoyle in Sept. 1903, and J. R. Hardy visited the locality during the winter of 1904 and found the species to be apparently breeding amongst the turfs, some twenty insects, in all stages of growth, having been sent to Sopp alive. On 30 Dec. 1904 one was caught in Liverpool Docks by J. Edwards and given to Sopp : this apparently had been introduced amongst grain from San Francisco.

About the same date *L. surinamensis* occurred abundantly in a tanpit adjoining the greenhouses of a private garden between Chelmsford and Bloomfield, Essex, and was doing considerable harm to the pine-apples, orchids, and other plants. There was no doubt of its breeding in this locality, as it had been established for several years and the specimens brought were of every age and size, from recently hatched young to mature insects. In the past few years numerous tropical plants had been brought into the garden and the cockroaches may have been brought with one of them.*

In 1906 one, which had been taken in Bradford Market, Yorkshire, was given to J. W. Carter. This, Porritt says, was the first recorded example for Yorkshire. During 1907–8 F. Rhodes gave Carter several specimens from a hothouse in Lister Park, Manningham, Yorkshire, where the species had become firmly established. To conclude the list, I received from G. T. Lyle a specimen found on Christmas Day 1908 in a hothouse at Bishopstoke, Hants.

Meanwhile *L. surinamensis* had become abundant at Kew Gardens. Though not known to be injurious, still it was looked on with considerable suspicion. It was infesting the cocoa-nut fibre beds in the tropical propagating-houses. Writing on 20 April 1907, G. Nicholson said it "is, or was, abundant in the tropical houses. It is extremely active, and disappears with a diving-like motion under the fibre. So far we have not noticed that it does any harm, and it is not trapped like *B. orientalis*, *P. americana*, or *P. australasiæ*. Hand-catching seems to be the only way of dealing with it." Apparently it has taken up its abode and intends to stay in Kew Gardens. "Handsome is as handsome does" no doubt ; but much as the authorities at Kew would prefer its room to its presence, it is, nevertheless, an interesting little "beast" of very elegant proportions, and will not disgrace the orthopterist's cabinet.†

* E. C. Horrell, 'Entomologist,' 1905, p. 92.

† In Ireland this cockroach has been found in Botanic Gardens—in Belfast (*Welch*) and in Dublin (*Halbert*).

Casual Cockroaches.

Quite a large number of species of cockroaches are known to have occurred as casuals in Britain. Far the greater part no doubt of those which are seen at all meet an untimely fate beneath the heel of the first observer, and of those which are preserved many probably have never been recorded, or the records have escaped my notice. So the somewhat lengthy list that follows is scarcely likely to be by any means exhaustive. It is quite possible, too, that the identification of even these is not always reliable. So far as can be seen, none seem likely to establish themselves here, so their occurrences and the list of them are really of very little importance. These cockroaches, in fact, cannot in any sense be looked upon as British insects. Apparently the most frequently occurring are *Rhyparobia maderæ* Fabr. and some of the green *Panchloræ—P. exoleta* Burm. and one or two other species, not easily distinguished from the last or from one another. An example of the former—a casual which I received alive—escaped for a time and deposited between some papers an ill-formed oötheca. At present my list of casuals is :

Ischnoptera strigosa Schaum. (= *natalensis* Wlk.).—One imported to Kew Gardens (*Lucas*).

Nyctibora holosericea Burm. (figured in 'Entomologist,' 1900, p. 3).—One from Ship Canal, Manchester, exhibited at Lanc. and Ches. Ent. Soc., 19 March 1906 (*Sopp*) ; one captured at Kew, June 1904 (*Sopp*) ; one in Mansfield Market-place, 28 February 1907 (*Daws*) ; one, Covent Garden, 6 July 1897, figured in 'Entomologist,' 1900, p. 3 (*Burr*) ; a nymph (probably) brought to Mr. Daws of Mansfield, April 1908.

Nyctibora brunnea Thunb.—Bradford Market, Yorkshire, one (*Carter*).

Nyctibora sericea Burm.—One, Sandown, Isle of Wight, 1906 (*Taylor*).

Heminyctobora truncata Sauss. & Z.—One [? Barnsley] (*Bayford*).

Phoraspis leucogramma Perty.—Liverpool Docks (*Sopp*).

Epilampra caraibæa Sauss. & Z.—A male from Queen's Square, Liverpool, received by Sopp, July 1902 (*Sopp*).

E. burmeisteri Guer.—One, November 1905, and one, January 1906, from the Ship Canal Docks, Manchester (*Sopp*).

E. grisea de Geer.—Louth, Lincolnshire (*Carter*).

Dorylæa rhombifolia Stoll. (= *Stylopyga decorata* Brun.).—One, Worksop, 20 March 1902 (*Shaw*) ; a living nymph, which had partly eaten another, given me by H. Main, 8 Sept. 1904 ; it came in a sugar-vessel from Java (*Lucas*) ; one, Natural History Museum, S. Kensington, 16 November 1907 (*Kirby*).

Eurycotis finschiana Sauss. & Z.—Louth, Lincolnshire (*Carter*).

Rhyparobia maderæ Fabr. (figured in 'Entomologist,' 1896, p. 169).—Several specimens observed in the streets of Plymouth about 20 years since [note written 1903] having flown from a ship in the Great Western Railway Docks (*Bignell*) ; one, found by H. O. Dixon in a desk at Covent Garden, Sept. 1900 (*Lucas*) ; one, taken at Chelsea, 1894 (*Briggs*) ; one, taken at Covent Garden, Nov. 1895 (*Briggs*) ; one, Bermondsey, 16 June 1896 (*Tutt*) ; Enfield Pool, August 1907 (Camb. Univ. Museum) ; one, Surbiton, 17 February 1908 (*Lucas*) ; several imported into Derby with fruit : specimens in Derby Museum (*Pullen*) ; Hoyland Common, near Barnsley, Yorkshire, alive amongst onions, 10 September (*Dyson*) ; Bradford, Yorkshire, one in an orchid-house (*Carter*).

Panchlora exoleta* Burm.—One, at Coalville, Leicestershire, June 1902 (*Shaw*); one, at Maxwelltown, Dumfries, 1902 (*Shaw*); one at Leeds, 9 December 1904 (*Brown*); in the wholesale market at Huddersfield, 18 March 1905 (*Wattam*); at Mansfield, Notts, 25 October 1906 (*Daws*); Hartlepool, one, 19 February 1914 (*Gardner*); Skelmanthorpe, Yorkshire, one flying about in the road (*Lawton*); Bradford, Yorkshire, in an orchid house (*Carter*); Bradford, another (*Carter*); one. (? Bournemouth) 1913 (*Tatchell*); Plymouth, Devon, one, December 1916.

Panchlora virescens* Thunb.—Liverpool, exhibited at Lanc. and Ches. Ent. Soc., 21 March 1904 (*Sopp*); Leyland, exhibited at Lanc. and Ches. Ent. Soc., 17 October 1904 (*Charnley*); Manchester, one in November, and one in December 1905 (*Garnett*); two, Manchester Ship Canal Docks, 21 November 1905 (*Ray-Hardy*); Hoylake, Cheshire, 9 August 1906 (*Jennings*); Warrington (*Collins*).

P. nivea* Linn.—Warrington, November 1907 (*Sopp*); one (probably this species) exhibited at Entom. Soc. Lond., 6 May 1908 (*Waterhouse*); one, Cupar, Fife, June 1909 (*Brown*); one, on the wing at Trentham, North Stafford, October 1910 (*Stott*); Louth, Lincolnshire (*Carter*).

P. viridis* Fabr.—One (probably this species), Romsey, 3 May 1901 (*Jenvey*); Liverpool, exhibited at Lanc. and Ches. Ent. Soc., 21 March 1904; Liverpool docks, one, 1896 (*Sopp*); (probably this species) occasionally imported into Edinburgh (*Evans*).

Nauphæta brazzæ Bolivar.—Four, found at Kew Gardens, 18 October 1898, in a case from the Belgian Congo State (figured in the 'Wild Fauna and Flora of Kew,' vi).

N. bivittata Burm. (= *cinerea* Oliv.).—One, found at Kew Gardens in a Wardian case received from Calcutta, April 1901 (Figured in the 'Wild Fauna and Flora of Kew,' vi); one exhibited at the S. Lond. Ent. and Nat. Hist. Soc., 9 Sept. 1909, as *N. circumvagans* by H. Main—no doubt this species.

Blabera gigantea Linn.—This very large cockroach, called "The Drummer" in Central America and the West Indies, has been taken in Liverpool Docks (*W. Gardner*); West India Docks, London (*Stephens*); Bradford in Yorkshire, about 1895 (*Sopp*); Huddersfield (*Sopp*).

Blabera cubensis Sauss.—Two, taken at Oxford—one 16 August 1906, the other 2 September 1906 (*Hamm*); introduced into Deptford by Shipping (? one) (*Moore*).

(*Ectobius pallens* Steph. ('Ill. Brit. Ins.' Mand. vi, p. 46) was described from a single dried specimen, which had been "taken near London." Eland Shaw says: "Fischer queries it as synonymous with *E. lapponicus* Linn." I have examined Stephens' specimen which is in the British Museum, and it is not an *Ectobia*, but a *Phyllodromia*, and I should think it probably a stray exotic species ("Syn. Brit. Orth." in 'Ent. Mo. Mag.' 1889, p. 369).)

* *P. exoleta*, *P. virescens*, *P. nivea*, and *P. viridis* are so much alike that identifications are in some cases doubtful. The last three possibly are not all distinct. These pale green *Panchloræ* have been taken once or twice in Ireland.

Sub-Order III. GRYLLODEA.
(Crickets.)

Four crickets are the sole British representatives of a group of insects which present not a few points of interest. Around one of them indeed—the house-cricket—tradition has spread a halo almost of sanctity, though in real life the housewife and the baker do not regard it with the same degree of favour. Romance, however, must be allowed to see with other eyes, when it contemplates the "Cricket on the Hearth," which novelists delight to honour and whose praises poets have so freely sung. The homely song of the cricket may perhaps be pleasant to some, and for a time may be tolerated by all on account of its associations; but the continuance of its shrill "piping" may well be understood to become a nuisance very soon.

We may define the GRYLLODEA as: *Orthoptera with slender, usually long, antennæ. Elytra (at rest) with the dorsal part lying flat on the body, and the lateral turned down over the sides. Tarsi usually of three segments; hind legs suited for leaping. "Ears" situated on the fore tibiæ, the "musical" apparatus being found on the basal part of the elytra of the male. Female with a long exserted ovipositor (except in Gryllotalpidæ and Tridactylidæ). Cerci long. Many wingless forms.*

Seven families are usually given as comprising the Gryllodea:—

W. 1. TRIDACTYLIDÆ.
W.B. 2. GRYLLOTALPIDÆ.
W. 3. MYRMECOPHILIDÆ.
W.B. 4. GRYLLIDÆ.
W. 5. ŒCANTHIDÆ.
W. 6. TRIGONIDIIDÆ.
7. ENEOPTERIDÆ.

In Britain we have representatives of two families only. Three of our four species fall into the typical family—Gryllidæ—the remaining one into the Gryllo-

talpidæ. Two only—*Gryllus domesticus* and *Gryllotalpa gryllotalpa*—are recorded from Scotland. Western Europe has a far more representative list.

Between the Gryllodea and the next sub-order—the Locustodea—there is a somewhat close connection. The "musical" organs are similarly situated, and in each the female has in general an exserted ovipositor; but on the other hand the tarsal segments are different in number, and the form of the elytra is not the same in both. This sub-order, however, would form a very natural group were it not for the Tridactylidæ and the Gryllotalpidæ, neither of which has an ovipositor, while the former has short antennæ. Since the Gryllotalpidæ live underground, their forelegs are so modified as to become efficient digging organs, resembling quite noticeably those of the "mole" itself. (This modification of the forelegs is shared with the Tridactylidæ.)

Speaking of British species primarily, the broad rounded vertex of the head is not separated from the "fore-head" by a furrow as in the Locustodea. The veining of the elytra is somewhat difficult to follow. Especially is this the case in species where the elytra are much altered by reduction, as in our wood-cricket (*Nemobius sylvestris*) and in the mole-cricket (*Gryllotalpa gryllotalpa*). Further complications of a confusing character are introduced in the case of the males, in that the basal parts of the elytra are modified to produce a stridulating instrument, which constitutes the "musical" apparatus. Fortunately the elucidation of the nervuration is not necessary for discriminating the four British species, which are so very dissimilar.

Both elytra are similar, the right usually lying upon the left, the contrary being the general arrangement in the Orthoptera. The wings are very different from the elytra, being ample and delicate. They are frequently rolled up at the apex, these portions having the appearance of a pair of additional cerci, and possibly being capable of use as sensory organs. The cerci themselves are not segmented, but are often very long

and flexible : they bear a variety of sense organs, and probably act the part of " posterior antennæ."

As in the Locustodea the hind legs are usually employed in jumping, and well some species are able to use them ; the mid and fore legs are simple walking legs, except in two families, in which, as already stated, they are changed into implements for digging. Each fore leg possesses a pair of tympana, or " ears." The tarsi have three segments, the first being long, the second very short, the third bearing the claws without pad or membrane between them.

It is scarcely necessary to state that the faculty of " singing " is well developed, and our four species are adepts at the art, but other members of the Gryllodea leave them far behind. To produce the sound one elytron has a file on its surface, while the other has a sharp edge on its margin. When the elytra are rapidly vibrated the sharp edge acting on the file produces the " musical " sound.

Crickets lay eggs without an egg-case of any kind, and the young resemble the adults somewhat closely, there being, as with the rest of the Orthoptera, but little post-embryonic development. They pass through a considerable number of ecdyses (possibly as many as a dozen) before becoming imagines.

Cockerell* mentions a couple of fossil Grylloids from the Oölite in Britain. Woods† states that Gryllidæ occur in the Lias and in the Oligocene amber.

Popular names have been bestowed upon each of our four crickets; but in this case the reason is probably not so much to be found in the fact that they are well known, as that they are sufficiently distinct from one another to make a common name possible. So little resemblance in fact is there between them that an identification table is scarcely necessary. The following artificial one is, however, given :—

* " Fossil British Insects " ('Proc. U.S. Nat. Mus.,' vol. xlix, No. 2119, p. 470).

† 'Palæontology,' p. 335.

ARTIFICIAL KEY TO BRITISH GRYLLODEA.

A. Ovipositor exserted; fore legs normal.		
(*a*). Spines of hind tibiæ long, slender, moveable; first segment of hind tarsi not serrate; species dark brown, small . . .	*10 mm.	*N. sylvestris.*
(*b*). Spines of hind tarsi strong, fixed; first segment of hind tarsi serrate on both sides, species larger.		
(1). Very dark and bulky .	23 mm.	*G. campestris.*
(2). Greyish-brown; less bulky . . .	18 mm.	*G. domesticus.*
B. Ovipositor not exserted; fore legs modified for digging; size very large . . .	45 mm.	*G. gryllotalpa.*

Genus 1. **GRYLLOTALPA** Latr.

Gryllotalpa LATR. Hist. Nat. Crust. Ins. iii, p. 275 . . . 1802.
Acheta part, LINN. Syst. Nat. (ed. x), i, p. 428 . . . . 1758.
Curtilla OKEN Lehrb. Nat. iii, p. 445 . . . . . 1815.

(Kirby, Syn. Cat. Orth. ii, p. 4 (1906), uses *Curtilla*, apparently to avoid the repetition *Gryllotalpa gryllotalpa*.)

DESCRIPTION. — Body downy. Antennæ sturdy, scarcely longer than the pronotum, with many segments. Two lateral ocelli developed, but the middle one abortive. Pronotum large and shield-like. Elytra reduced in size and somewhat triangular in shape; nervuration not normal. Wings fully developed in both sexes; in a position of rest the tips rolled up forming a tail. Fore legs much altered to form implements for digging. Mid and hind legs as in the rest of the Gryllodea: posterior femora dilated. The abdomen showing nine segments in the male and seven in the female. No ovipositor visible. The cerci very long, curved, and downy. The genus is well distributed over the world, and all species are

* Average length of the female from the front of the head to the base of the ovipositor.

fossorial. The only European species, *Gryllotalpa gryllotalpa* Linn., is the type of the genus.

1. **Gryllotalpa gryllotalpa** Linn.

(Plate XII, figs. 1 and 2.)

gryllotalpa	Linn. Syst. Nat. (ed. x), i, p. 428, n. 19	1758—*Gryllus* (*Acheta*).
,,	Linn. Faun. Suec. p. 236, n. 866	1761—*Gryllus*.
gryllo talpa	White Nat. Hist. of Selborne, Letter xlviii	1789—*Gryllus*.
talpa	Oliv. Enc. Méth., Ins. vi, p. 633, n. 1	1791—*Gryllus*.
vulgaris	Latr. Hist. Nat. Crust. Ins. xii, p. 122	1804—*Gryllotalpa*.
,,	Curtis Brit. Ent. No. 456 .	1833—*Gryllotalpa*.
,,	Brunner Prod. der. Eur. Orth. p. 451, f. 107	1882—*Gryllotalpa*.
,,	Finot Faune de la Fr. Orth. p. 246, pl. xii, f. 159 . .	1889—*Gryllotalpa*.
,,	Eland Shaw Syn. Brit. Orth. in Ent. Mo. Mag. p. 173 .	1890—*Gryllotalpa*.
gryllotalpa	Burr Brit. Orth. p. 67, pl. v, f. 7	1897—*Gryllotalpa*.
Gryllotalpa	Kirby Syn. Cat. Orth. ii, p. 4 .	1906—*Curtilla*.
gryllotalpa	Burr Syn. Orth. W. Eur. p. 148	1910—*Gryllotalpa*.
,,	Lucas Proc. S. Lond. Ent. Soc. p. 53, pl. vi, f. 1 . . .	1915—*Gryllotalpa*.

Original Description.

Gryllotalpa. 19. G. A. thorace rotundato, alis caudatis elytro longioribus, pedibus anticis palmatis tomentosis.
Fn. svec. 619. Gryllus pedibus anticis palmatis.
Habitat in Europæ *et* Americæ *borealis herbosis et cultis, Hortorum hostis.*
(C. Linnæus, 'Syst. Nat.' (Ed. x), tom. i, p. 428, 1758.)

866. Gryllus *Gryllotalpa* thorace rotundato, alis caudatis elytris longioribus, pedibus anticis palmatis tomentosis.
Gryllus pedibus anticis palmatis. *Fn.*.619.
Habitat in *Scania* campestri, ubi vesperi cantillat uti Rana Hyla vel Rallus Crex. Hortis noxius.
Descr. Differt a reliquis manifeste variis notis. 1. Magnitudine, utpote omnibus nostris insectis, excepto Cancro, major. 2. Pedibus anticis villosis et palmatis. 3. Alis superioribus cinereis vasis nigricantibus: inferioribus longioribus, acuminatis. Cauda biseta est, uti sequentis.
(C. Linnæus, 'Faun. Suec.,' p. 236, 1761.)

Male Imago.—General *colour* dark reddish-brown, darker in parts, legs paler. *Size* large; *length* some

45 mm. *Surface* somewhat pubescent. *Head* extended, pointed; *antennæ* rather short, but of many segments; *eyes* small but prominent; lateral *ocelli* well marked, but median one abortive. *Pronotum* large, shield-like, slightly hollowed in front, rounded behind. *Elytra* abbreviated; radial nervure with many branches; nervures strongly marked. *Wings* fully developed, forming, when folded, two long tails, usually extending beyond the tip of the abdomen. *Forelegs* (fig. 18) very strong, dilated so as to form digging organs; *coxæ* large; *trochanter* produced into a pointed process; *femora* compressed, sinuate on the lower margin; *tibiæ* dilated, lower margin with four pronounced teeth; on the inner side below the upper margin a slit-like tym-

Fig. 18.—Foreleg of *Gryllotalpa gryllotalpa* Linn. (× 3).

panum (or auditory organ); *tarsi* with first two segments dilated and pointed, the distal one small with two small, straight, unequal claws. *Mid* and *hind legs* much as in other Gryllodea, but the femora and tibiæ somewhat dilated. Hind tibiæ with a few strong spines. *Abdomen* showing nine segments, and bearing at its apex two hairy *cerci*, nearly as long as the antennæ.

Female Imago (Pl. XII, figs. 1 and 2).—Very closely resembling the male, for the abdomen, although showing but seven segments, is very like that of the male, and the wings in both sexes are fully developed. Further there is no exserted ovipositor. A point of distinction may be seen in the elytra, as the cells at the base are more regular in the female than in the male. The males seem to be scarce. Curtis says that in the two he had seen the right elytron overlapped the other, whereas the reverse was the case in the females.

Eggs.—The mole-cricket is credited with laying some 200–400 eggs which hatch in three to four weeks. Gilbert White's oft-quoted letter xlviii contains the following interesting note:—"About the beginning of May they lay their eggs, as I was once an eye-witness; for a gardener at a house where I was on a visit, happened to be mowing, on the 6th of that month, by the side of a canal, his scythe struck too deep, pared off a large piece of turf, and laid open to view a curious scene of domestic economy. There were many caverns and winding passages leading to a kind of chamber, neatly smoothed and rounded, and about the size of a moderate snuff-box. Within this secret nursery were deposited near a hundred eggs of a dirty yellow colour, and enveloped in a tough skin, but too lately excluded to contain any rudiments of young, being full of a viscous substance. The eggs lay but shallow, and within the influence of the sun, just under a little heap of fresh-mowed mould, like that which is raised by ants." G. W. Kirkaldy in a paper on "Maternal Solicitude in Rhynchota and other Non-social Insects" ('Entom.' 1903, p. 113) states that the earliest reference to parental care in the mole-cricket appears to be that of Goedaerdt,* who states that it takes particular care of its eggs, raising up the nests in a hot and dry season, so that the young almost touch the surface of the earth and are thereby cherished by the sun's heat; contrariwise they sink the nests down when the air is cold and moist. They also act as unceasing sentinels round the nest. Roesel cites this account and gives a coloured sectional drawing of the nest and eggs. Audouin states that all authors agree in saying that the mole-cricket takes the greatest care of its young, but Goedaerdt is the only author Kirkaldy can trace who relates his personal observations. Kirby and

* Goedaerdt in 'Metamorphosis Naturalis' (cir. 1669) gives in pl. lxxvi, vol. i, p. 140, a fairly good figure of the mole-cricket, and below it a batch of eggs in "nest."

Spence speak of a female defending with its jaws the eggs, which were menaced by a black ground-beetle.

Nymph.—Between the nymph and the imago the resemblance is very close, except for the smaller size of the former and the absence or rudimentary condition of the organs of flight. It seems clear that the nymph requires more than a year to complete its growth and become an imago. It therefore must hibernate, as the imago probably does also, for Bracken took a full-grown male alive on the sand-hills near St. Minver, North Cornwall, during the week ending 20 December 1912. The mother watches the newly-hatched young carefully and, it is said, supplies them with food till their first ecdysis, after which they disperse and look after themselves. Staveley says, however, that they live together till they are adult during the summer following after that in which they were hatched. It has been stated that the mother eats most of the young; but another writer says that it is only the males which are guilty. Some of these statements, however, probably need confirmation.

Variation.—There is a rare variety with abbreviated wings, *Gryllotalpa cophta* de Haan, which was considered a distinct species, but is now referred to *G. gryllotalpa* Linn., variation in wing-length being not uncommon amongst the Orthoptera, and insufficient to distinguish species. Var. *cophta* has been taken at Brindisi and elsewhere (*Brunner*).

Date.—About mid-April the mole-crickets may be heard singing their love-ditty in a low dull jarring uninterrupted note not unlike that of the nightjar or goatsucker (*Caprimulgus europæus* Linn.), but more inward.* Gilbert White found that in one case they laid their eggs about the beginning of May. If these hatch in three or four weeks, the young nymphs would be about in the summer. It seems that these are not adult till the next year. Their parents also, it would

* Kirby & Spence, ii, p. 394.

appear, may survive the winter, witness the example, already mentioned, taken by Bracken on 20 Dec. 1912. The mole-cricket is not now common in Britain, so it does not seem possible to speak definitely of its habits here.

Habits.—Four common names at least have been bestowed on *Gryllotalpa gryllotalpa*, and all are appropriate—mole-cricket, fen-cricket, churr-worm, and eve-churr. The most cursory examination of the forelegs reveals the fact that these are wonderfully well adapted as tools for burrowing in the ground. Placed on soil such as it likes—wet or swampy ground especially—the mole-cricket buries itself with great rapidity. It works along underground like a field-mouse, raising a ridge as it goes.* It is able to run backwards quite easily, a feat which must be extremely useful to it while moving about its burrows. That the long cerci (and even the curled-up wing-tips) act as antennæ under such circumstances is certainly reasonable, but cannot be said to have been proved. The mole-cricket is a cumbersome looking insect, but it takes to the wing nevertheless. G. Dalgliesh took one in Surrey —a very fine specimen—which flew against his face about 9 p.m. in June. Parfitt mentions examples in the streets of Exeter early in the morning, the inference being that they flew there. H. Moore found one in Lower Road, Deptford, which he considered to have been attracted by the electric light. F. W. Sowerby mentions the mole-cricket having been attracted by light in Egypt. Curtis† says: "This insect is supposed to be the 'Will o' the wisp,' the '*ignis fatuus*,' about which so much has been said and so little proved, the phantom that has eluded the vigilance of the naturalist and the curious for ages." Kirby and Spence‡ say that in 1780 a learned friend had a mole-cricket brought to him by a farmer, who

* Kirby & Spence, ii, p. 362.
† 'British Entomology,' No. 456.
‡ Kirby & Spence, ii, p. 416.

told him that one of his people, seeing a *Jack-o'lantern*, pursued it and knocked it down, when it proved to be the insect shown to him. Since there seems no reason for doubting the record, perhaps we may presume that this particular insect was rendered luminous through being attacked by a fungus.

Meadows, peat-bogs, and damp ground generally seem to be the favourite habitat of the mole-cricket; consequently the sides of ponds, streams, and canals suit them well. Where they are plentiful they may invade potato-fields, gardens, hot-beds, and dunghills. Samouelle says that though horse-dung attracts them, hog's dung expels them. If they get into cultivated ground in any numbers they do much damage by burrowing underground and devouring the roots and tubers. In France they damage the roots of the grass. They, however, will eat animal food. Staveley says they have been known to attack and devour each other! In captivity Burr fed them on potatoes, turnips, meat, etc., keeping them in cages, but taking the precaution of separating individuals to prevent fighting and mutilation. So far as the British Isles are concerned it seems scarcely necessary to state that "they may be killed by pouring boiling water mixed with a little oil into their holes; they then come up to die" (*Burr*).

Gilbert White,* who seems to have had an exceptional opportunity of observing this insect at Selborne, says: "*Gryllus gryllo talpa* (the mole-cricket) haunts moist meadows, and frequents the sides of ponds and banks of streams, performing all its functions in a swampy wet soil. With a pair of fore-feet, curiously adapted to the purpose, it burrows and works under ground like the mole, raising a ridge as it proceeds, but seldom throwing up hillocks.

"As mole-crickets often infest gardens by the sides of canals, they are unwelcome guests to the gardener, raising up ridges in their subterranean progress, and rendering the walks unsightly. If they take to the

* 'Nat. Hist. of Selborne,' Letter xlviii, 1789.

kitchen quarters, they occasion great damage among the plants and roots, by destroying whole beds of cabbages, young legumes, and flowers. When dug out they seem very slow and helpless, and make no use of their wings by day; but at night they come abroad, and make long excursions, as I have been convinced by finding stragglers, in a morning, in improbable places. In fine weather, about the middle of April, and just at the close of day, they begin to solace themselves with a low, dull, jarring note, continued for a long time without interruption, and not unlike the chattering of the fern-owl, or goat-sucker, but more inward. . . .

"When mole-crickets fly they move '*cursu undoso*,' rising and falling in curves, . . ."

Distribution.—*G. gryllotalpa* is found in the British Isles, Sweden, Holland, Belgium, France, Spain, Italy, Egypt, etc.—in fact, speaking generally, its habitat is Europe, Western Asia, and Northern Africa.

British Localities.

In the British Isles the mole-cricket appears now to be seldom noticed, though probably it is not so scarce as this would seem to imply. Like its namesake with the velvet fur, it is an underground animal, and may therefore very easily escape notice. There seems, however, reason to suppose that it is less common with us than it used to be. Although I have received living examples I have never met with it myself, and know personally of but one locality where it is permanently established. At a certain spot in the south of the New Forest one of the keepers seems at any time to be able to obtain specimens by digging for them in the clayey soil. From this locality I have several examples, and from the same source, I believe, came one in July 1911 which measured about 50 mm. in length and 66·5 mm. in wing-expanse. The following records have come under my notice :—

England.—*Berks :* Besselsleigh (*Distant*). *Cambridgeshire :* Ickleton, 1780 (*Kirby & Spence*). *Cornwall :* A male imago taken alive on the sandhills at St. Enodoc near St. Minver, December 1912 (*Bracken*). *Derbyshire :* Although described by Glover ('History of the County of Derby,' 1829) as

"often infesting gardens by the side of canals," the absence of any confirmatory evidence renders its occurrence very doubtful (*Jourdain*). *Devon:* (*Stephens*). Bignell had seen three found in a potato-patch, which had consumed a great portion of the potato under which they were found in September (*Bignell*). Rather frequent in the neighbourhood of Exeter; a few years since (*sc.* 1882) several were found in the streets early in the morning (*Parfitt*). Bracken (1916) seems to write somewhat doubtfully of it as a Devon insect at the present time. *Hants:* Isle of Wight. Burr states in 'The Natural History of the Isle of Wight' (F. Morey, 1909): "Mr. Morey writes me that he has seen specimens which were dug up in a garden at Newport many years ago. Mr. P. Wadham, of Newport, found nine of these insects about six years since when turning over a heap of damp sandy soil in his garden through which flows the stream known as the Lukely. He has also dug out specimens on the banks of the Medina at Shide"; Netley (*Briggs*); Southampton, a living example exhibited by W. Sharp at Entom. Soc. Lond. 2 Nov. 1887, having between the spines of its hind legs a number of living acari (*Sharp*); Selborne, very common in the time of Gilbert White, about 1789; New Forest, Brockenhurst, and near Ramnor (*Lucas*). *Kent:* a living specimen found outside his house in Lower Road, Deptford (no doubt attracted by electric light) exhibited by H. Moore at S. Lond. Ent. and Nat. Hist. Soc. 8 Sept. 1904 (*Moore*). *Lancashire:* near Manchester (*Jacoby*). *Lincolnshire:* Grimsby, July 1902 (*Hicks*). *Norfolk:* Stoke Holy Cross (*Edwards*); Caistor, occasionally (Paget, *fide Bloomfield*). *Oxon:* near Oxford (*Shipp*). *Staffordshire:* Taken in gardens about Birmingham (R. Garner's 'History of the County of Stafford,' 1844 (*teste Jourdain*). *Surrey:* Churt, 1901 and another in 1908 (*Dalgliesh*); one, which flew against Mr. Dalgliesh's face outside his garden-gate at Milford about 9 p.m. on 3 June 1902, and fell down: it was a very fine specimen. *Sussex:* By Chichester Canal (*Anderson*). *Wilts:* Hartmoor near Devizes (*Lyle*).

Scotland.—Sibbald (1684) gives Gryllotalpa, the Mole, or Fen Cricket as a Scotch insect; G. Don (1913) mentions it for the county of Forfar. W. Evans, however, can find no evidence corroborative of Sibbald and Don's statements. He says further (Jan. 1901) that sixty years ago the Rev. J. Duncan wrote: "The Mole Cricket is unknown in Scotland" ('Nat. Lib. Entom.' vol. i, 1840, p. 247). It is satisfactory to note that this is no longer true, for in 1899 a single

example was taken at Kilmalcolm in Renfrewshire, and is now in the Museum at Paisley (*Stewart*).

Ireland.—One example only represents Ireland also. It is a female taken in County Derry, and presented by Major Bruce to the collection at Trinity College, Dublin. The insect was found in an old buried canoe near Trome at the northern end of Lough Neagh 1899 (*fide Kemp*).

Genus 2. **NEMOBIUS** Serv.

Nemobius Serv. Ins. Orth. p. 345 . . . . . 1839.
Pronemobius Bolivar Ann. Sci. Nat. Porto, v, p. 41 . . . 1898.

Description.—Size small. The whole body bearing rather long scattered hairs. Head short, blunt; ocelli, when in evidence, arranged in the form of a triangle. Elytra abbreviated, truncate, radial nervure without branches. Wings (in European species) absent. The fore tibiæ furnished with a tympanum on the outer side only. Hind tibiæ with long moveable spines, and six terminal spurs. First segment of hind tarsi hairy, neither sulcate nor serrate above. Ovipositor straight or somewhat incurved. Type of the genus *Nemobius sylvestris* Fabricius.

1. **Nemobius sylvestris** Fabricius.

(Plate XIII, figs. 1 and 2.)

sylvestris Fabr. Ent. Syst. ii, p. 33, n. 18 . . 1793—*Acheta.*
„ Latr. Hist. Nat. Crust. Ins. xii, p. 124 . 1804—*Gryllus.*
„ Curtis Brit. Ent. vii, pl. ccxciii . . 1830—*Acheta.*
„ Serv. Orth. p. 348, no. 1 . . . . 1839—*Nemobius.*
„ Brunner Prod. der. Eur. Orth. p. 424, f. 98 . . . . . 1882—*Nemobius.*
„ Finot Faune de la Fr., Orth. p. 234, pl. xii, f. 151 . . . . . 1889—*Nemobius.*
„ Eland Shaw Syn. Brit. Orth., in Ent. Mo. Mag. p. 170 . . . . . 1890—*Nemobius.*
„ Burr Brit. Orth. p. 64, pl. v, f. 4 . . 1897—*Nemobius.*
Sylvestris Kirby Syn. Cat. Orth. ii, p. 14 . . 1906—*Nemobius.*
sylvestris Burr Syn. Orth. W. Eur. p. 138 . . 1910—*Nemobius.*
„ Lucas Proc. S. Lond. Ent. Soc. p. 51, pl. vi, f. 4 . . . . . 1915—*Nemobius.*

Original Description.

18. A. aptera nigra elytris fornicatis brevissimis cinereis fusco lineatis. *sylvestris.*
Habitat in Gallia Mus. Dom. Bosc.

Declarata videtur. Corpus parvum, nigrum. Caput atrum, nitidum orbita oculorum subpallescente. Thorax pallens margine omni nigricante. Elytra brevia, fornicata, pallescentia, fusco striata. Abdomen nigrum ense recurvo, nigro, stylis duobus longiore.
(J. C. Fabricius, 'Ent. Syst.' ii, p. 33, n. 18, 1793.)

Male Imago (Pl. XIII, fig. 1).—General *colour* very dark brown with paler markings. *Surface* sparsely hairy. *Length* some 9–10 mm. Head short, black, with yellow markings, the most noticeable being a pentagon. *Maxillary palpi* dilated and otherwise modified. *Elytra* abbreviated, truncated, longer than the pronotum, nervures dark. *Wings* absent. *Pronotum* with upper surface somewhat paler than the general colour. *Fore tibiæ* with an auditory organ (tympanum) on the outer side only. *Hind tibiæ* with spines long and moveable—six at the distal end, and above them three on each margin arranged alternately. Basal segment of *hind tarsi* hairy. *Cerci* long, rather pale, hairy. *Sub-genital lamina* compressed and bluntly pointed.

Female Imago (Pl. XIII, fig. 2).—A little larger than the male. *Elytra* much shorter, nervures dark, straight; hind margins forming a concave ∧. *Ovipositor* straight; at least as long as the abdomen.

Nymph.—Except when nearing maturity, the nymph may of course be readily distinguished by its smaller size. Further it lacks the elytra, and is even darker in colour than the adult.

Date.—Imagines are numerous in the New Forest in late summer, and, as some are to be found in spring and autumn, it would appear that they may sometimes (if perhaps but seldom) hibernate at that stage. As evidence of this G. T. Lyle sent me thence three living examples, which he had found crawling and hopping about on fallen sweet chestnut leaves on 12 February 1910. Two were nymphs, but the third, a female, appeared to be adult. Of the small ones he saw great numbers, but he met with only the single

large specimen. Again on 12 November 1911 he sent me a male which he found hopping about amidst fallen oak leaves on the 5th of the month at Pignell Wood. Nymphs may be obtained nearly the whole year through. On 1 March 1914, for example, a short search was made in a known locality in the Forest, when one nymph at least was seen, but no imago. On the 10th of April in the same year I saw in a spot near Lady Cross, amongst dead leaves, a number of nymphs and with them one male, much larger than the rest, but not an imago. Both imagines and small nymphs were obtained on 8 September 1912. B. S. Harwood met with this cricket in the Forest in October 1912, but the condition is not recorded. It would therefore appear that breeding takes place in the summer, but that the young do not become adult till late spring or early summer of the next year.

Habits, etc.—In the New Forest this little cricket appears to frequent dry banks, especially where there are plenty of fallen leaves. If the bank is by the side of a stream the crickets seem to keep well above the water. I cannot recall having met with them amongst coniferous trees, the fallen leaves from which would not afford the kind of cover they evidently like. Both sexes run about very rapidly by fits and starts when first disturbed, and often take short leaps of some 9 or 10 inches in length, so they are rather difficult to catch. They may be running and hopping about in all directions when first discovered in any spot, but after a time, if still disturbed, they take cover till there is little evidence of their presence. The hand seems to be the best means to employ for their capture, but being delicate little creatures, they are sometimes damaged in the process. Indeed specimens are often taken that have lost a hind leg. What is their natural food it is hard to say. Lyle once sent me a female (one out of four specimens) which he found, about 10 September 1916, amongst the debris of a decayed *Boletus*. Of course they may simply have been

sheltering there, or have come to feed on the many living creatures that such a fungus usually contains. As the result of observations on specimens in captivity they would seem to be rather general feeders. On 2 August 1915 I captured some females in the neighbourhood of Lady Cross in the New Forest. These were kept alive at home and supplied with food of various kinds. Leaves of *Pyrus torminalis* Ehrh. (service tree) happened to be given them; on these they fed. Banana was also accepted. Bread was readily eaten on 12 August, and the next day they fed freely on raw beef. Later in the day (13th) I noticed a quantity of cork fragments in the large tube in which they were confined, bitten off, I presume, in an attempt to make a way out of the prison. They would not take to a nasturtium leaf. One escaped on August the 14th. The next day the remaining two were offered a piece of cheese, but they did not appear to eat it readily. A rose leaf was but little attacked, although *Pyrus torminalis* (of the same Natural Order) had seemed quite acceptable. When in captivity apparently bread is a suitable food; but it is possible that in nature these crickets are omnivorous, like their relatives of the kitchen. Like them also the wood-crickets are very "musical" in summer days in the New Forest. On August nights, too, when scarcely a living thing betrays its presence by sound, a quiet chirping is occasionally heard, which I presume is due to these little crickets.

Distribution.—*N. sylvestris* is found in woods throughout Central Europe (*Burr*). Though of limited distribution in Britain, it occurs across the sea in Holland, Belgium, and France. Apparently it is less general in the south, but has been taken in Spain, as well as in Algeria on the other side of the Mediterranean.

British Localities.

Curtis tells us that this cricket was first discovered as British by J. C. Dale who found it "amongst dead leaves

in a gravel-pit, the middle of August, near Lyndhurst in the New Forest." I have met with it in many parts of the Forest; in fact anyone wishing to capture it, will find this quite easy, so long as he will bear in mind the habits of the insect. Till recently the New Forest was considered to be its only British habitat; but Burr is able to say*: "This species has occurred commonly for the last ten years or more at Bordwood, near Sandown (in the Isle of Wight); and has also been noticed in Parkhurst Forest (*Poole*); swept in Parkhurst Forest, August, 1907; also on previous occasions (*Morey*)." There is no inherent reason why it should not be found in oak or mixed woods in other places. Perhaps the most promising spots in which to search for it would be dry sunny banks in the rides and clearings. Parfitt states that he found one specimen in a wood near St. Mary's Clyst in Devonshire, and the Rev. F. C. R. Jourdain once told me that a single specimen had been taken at Willington in Derbyshire by G. Pullen. Although these need confirmation as new habitats, there is no reason why they should not be such.

Genus 3. **GRYLLUS** Linn.

Gryllus (*Acheta*) Linn. Syst. Nat. (ed. x) i, pp. 425–433 . . 1758.
Acheta Fabr. Syst. Ent. p. 279 . . . . . 1775.
Gryllus Latr. Hist. Nat. Crust. Ins. iii, p. 276 . . . . 1802.
Liogryllus Sauss. Mém. Soc. Genève, xxv, p. 134 . . . . 1877.

Linnæus' Description.

194. GRYLLUS. *Caput* nutans, maxillosum, palpis quatuor ad maxillas.
Antennæ setaceæ.
Alæ deflexæ: superiores flexiles, submembranaceæ.
Pedes saltatorii plerisque.

Linnæus thus subdivides the genus:—

*Mantis. *Thoraxe elongatus, sublinearis. Pedes antici remotissimi a reliquis.* (10 species.)

**Acrida. *Caput conicum thorace longius, Antennis ensiformibus.* (2 species.)

***Bulla. *Thoraxe carinatus. Antennæ thorace breviores.* (6 species.)

****Acheta. *Cauda setis duabus.* (4 species.)

*****Tettigonia. *Cauda ensifera feminis.* (17 species.)

******Locusta. *Cauda simplex.* (20 species.)

On page 432 is the following foot-note:—

Grylli *Larvæ pleræque habitant sub terra, pupæ etiam excurrunt et cum parentibus plantas vorant, dum mares stridenti musica sonant.*

And on page 433:—

Gryllos *cum Blattis ordine naturali jungerent Hemipteris, si Character obtineretur combinans.*

(C. Linnæus, 'Syst. Nat.' (ed. x), i, pp. 425–433, 1758.)

* 'Nat. Hist. of Isle of Wight,' F. Morey, 1909.

Table of Species.

1. Large and bulky; colour chiefly black; wings abbreviated; ocelli nearly in a straight line; length 23 mm. . . *G. campestris.*
2. Smaller and more slender; colour grey-brown; wings fully developed; ocelli in a triangle; length 18 mm. . . *G. domesticus.*

1. **Gryllus campestris** Linn.

(Plate XIII, fig. 3.)

campestris	Linn. Syst Nat. (ed. x) p. 428 .	1758—*Gryllus* (*Acheta*).
,,	Fabr. Syst. Ent. p. 281, n. 7 .	1775—*Acheta.*
,,	Schrank Enum. Ins. Austr. p. 244, n. 465	1784—*Gryllus.*
,,	White (Gilbert) Nat. Hist. Selborne, Letter xlvi . .	1789—*Gryllus.*
,,	Sauss. Mém. Soc. Genève, xxv, p. 105	1877—*Liogryllus.*
,,	Brunner Prod. der Eur. Orth. p. 428	1882—*Gryllus.*
,,	Finot Faune de la France, Orth., p. 237, pl. xii, f. 152 . .	1889—*Gryllus.*
,,	Eland Shaw Syn. Brit. Orth., in Ent. Mo. Mag. p. 171 . .	1890—*Gryllus.*
,,	Burr Brit. Orth. p. 65, pl. v, f. 5	1897—*Gryllus.*
Campestris	Kirby Syn. Cat. Orth. ii, p. 25 .	1906—*Acheta.*
campestris	Burr Syn. Orth. W. Eur. p. 140	1910—*Gryllus.*
,,	Lucas Proc. S. Lond. Ent. Soc. p. 52, pl. vi, f. 3 . . .	1915—*Gryllus.*

Original Description.

campestris. 21. G. A. thorace rotundato, cauda biseta stylo lineari, alis elytro brevioribus, corpore nigro.
Habitat in Europa *australiore.*
(C. Linnæus, 'Syst. Nat.' (ed. x), i, p. 428, 1758.)

Male Imago (Pl. XIII, fig. 3).—General *colour* black; *build* bulky; *size* large; *length* up to 23 mm. *Head* large, globular, broader than the pronotum; *ocelli* nearly in a straight line, the middle one a little the lower. *Pronotum* small compared with the head. *Elytra* longer than the abdomen, smoky brown, when closed with a yellowish streak extending across their base. *Wings* shorter than the elytra. *Hind femora* bright brown below. *Hind tibiæ* with five spines on each internal margin (in addition to the apical spines).

Female Imago.—By the presence of a straight ovipositor some 12–14 mm. long, the female may readily be distinguished from the male, which in general appearance it otherwise much resembles. The elytra are one or two mm. less in length than in the male, and less distinctly coloured.

Eggs.—Gilbert White describes some taken from the body of a female, as numerous, long and narrow, of a yellow colour, and covered with a very tough skin.

Nymph.—In colour the nymph is shining black with a slight bronzy tint. It is found in the autumn and again in the early spring. It appears to have six or seven ecdyses and is mature during the summer months.

Variation.—Very occasionally a form is found with fully developed wings. This has been described by Krauss as var. *caudata*. It is not recorded for Britain. There is such a specimen in the Hope Collection at Oxford, which Burr, however, thinks may be *G. bimaculatus* De Geer.

Habits.—Gilbert White had special opportunities for examining the habits of this cricket, which is now apparently rare with us. His observations he has recorded in Letter xlvi of his 'Natural History of Selborne.' I cannot do better than quote the greater part of it:

"There is a steep abrupt pasture-field interspersed with furze close to the back of this village, well known by the name of the Short Lithe, consisting of a rocky dry soil, and inclining to the afternoon sun. This spot abounds with the *Gryllus campestris*, or field-cricket; which, though frequent in these parts, is by no means a common insect in many other counties.

". . . They are so shy and cautious that it is no easy matter to get a sight of them; for, feeling a person's footsteps as he advances, they stop short in the midst of their song, and retire backward nimbly into their burrows, where they lurk till all suspicion of danger is over.

"At first we attempted to dig them out with a spade, but without any great success; for either we could not get to the bottom of the hole, which often terminated under a great stone; or else, in breaking up the ground, we inadvertently squeezed the poor insect to death. Out of one so bruised we took a multitude of eggs, which were long and

narrow, of a yellow colour, and covered with a very tough skin. . . .

". . . [But] a pliant stalk of grass, gently insinuated into the caverns, will probe their windings to the bottom, and quickly bring out the inhabitant. . . . It is remarkable that, though these insects are furnished with long legs behind, and brawny thighs for leaping, like grasshoppers; yet when driven from their holes they show no activity, but crawl along in a shiftless manner, so as easily to be taken; and again, though provided with a curious apparatus of wings, yet they never exert them when there seems to be the greatest occasion. The males only make that shrilling noise; . . . it is raised by a brisk friction of one wing against the other. They are solitary beings, living singly male or female, each as it may happen; . . . the wings may be useful perhaps during the hours of night. When the males meet they will fight fiercely. . . . With their strong jaws, toothed like the shears of a lobster's claws, they perforate and round their curious regular cells, having no fore-claws to dig, like the mole-cricket. . . . Of such herbs as grow before the mouths of their burrows they eat indiscriminately; and on a little platform, which they make just by, they drop their dung; and never, in the day time, seem to stir more than two or three inches from home. Sitting in the entrance of their caverns they chirp all night as well as day from the middle of the month of May to the middle of July; and in hot weather, when they are most vigorous, they make the hills echo; and, in the stiller hours of darkness, may be heard to a considerable distance. In the beginning of the season their notes are more faint and inward; but become louder as the summer advances, and so die away again by degrees. . . . The shrilling of the field-cricket, though sharp and stridulous, yet marvellously delights some hearers, filling their minds with a train of summer ideas of everything that is rural, verdurous, and joyous.

"About the 10th March the crickets appear at the mouths of their cells, which they then open and bore, and shape very elegantly. All that ever I have seen at that season were in their pupa state, and had only the rudiments of wings, lying under a skin or coat, which must be cast before the insect can arrive at its perfect state; from whence I should suppose that the old ones of last year do not always survive the winter. In August their holes begin to be obliterated, and the insects are seen no more till spring. . . .

"One of these crickets, when confined in a paper cage and set in the sun, and supplied with plants moistened with water, will feed and thrive, and become so merry and loud as to be irksome in the same room where a person is sitting; if the plants are not wetted it will die." (*Gilbert White*, 1789.)

In Italy these crickets are kept in little wicker-cages for the sake of their song, in much the same way as Gilbert White kept them. To a meeting of the Entom. Soc. of London, 21 October 1896, W. B. Spence sent from Florence for exhibition specimens in such cages. He stated that they were sold by the Italians on Ascension Day in accordance with an ancient custom. The Rev. A. E. Eaton says that in Lisbon and Oporto male field-crickets are sold in

miniature cages by bird-fanciers at the rate of a penny apiece. They are kept in stock by hundreds together in open tea-chests, lined for the first three or four inches from the top with strips of tin, and are fed upon lettuces. The inhabitants like to have a "grillo" in the room and make pets of them. Their song is more sonorous than that of the house-cricket, and attention has been called to the fact that it becomes sharper before rain.

No doubt the field-cricket is a somewhat omnivorous feeder; in captivity it may be fed on lettuce, sugar, meat, etc. Burr says it chews wood, paper—anything; it sometimes turns cannibal. Curtis remarks: "I have been informed that in France children decoy these insects from their burrows by inserting a fly attached to the end of a horse-hair."

Distribution.—*G. campestris* is found throughout Europe except in the extreme north, and is reported from Asia Minor, Algeria, and Egypt; its favourite haunts are hot and dry spots. In Switzerland it reaches an altitude of 6,500 ft.

British Localities.

Apparently the field-cricket was once more common in England than it is now. Whether this was the case or not, everything points to the fact that at the present day it is very rare and local. Stephens recorded it from Windsor, New Forest,* Devon, and Cornwall, but there seems to be no further confirmation of its presence now in any of these localities. Records I am able to give are:

England.—*Hants:* Common at Selborne in White's time (1789). In 1904 C. W. Dale told me that he had four specimens taken by his brother at Christchurch in 1885. These are no doubt four of the eight examples in the "Dale Collection" now in Oxford. In 1901 I received from Major R. B. Robertson a nymph taken at Pokesdown, probably the previous year. *Norfolk:* Reported by J. Edwards. *Staffordshire:* Rare, but caught in North Staffordshire (R. Garner's 'History of the County of Stafford,' 1844, *fide Rev. F. Jourdain*).

* There is a male in the Hope Collection in Oxford, labelled "Weaver, N. F.," which may be a New Forest specimen.

Surrey: A colony between Eashing and Godalming, whence J. G. Dalgliesh received specimens. In the Victoria History of Hampshire Burr mentions Farnham (*Smith*): apparently Farnham is the Surrey town, which, however, is near the Hampshire border. One, Rotherhithe, 1904 (*Moore*). *Sussex:* In December 1899 I received a male from Rev. E. N. Bloomfield, which was taken at Pett in that year. It was discovered by its shrill voice, and was found on lifting up a slab of wood in a temporary bathing-shed on the beach. It was said to have been in a hole beneath the slab. It was the only specimen, and Bloomfield had seen no other. C. A. Briggs had a male obtained from Bennett's sale in 1891; and E. B. Nevinson has a male bought in an old collection of aculeates formed by Dr. Dowie of Eastbourne.

Scotland.—C. Stewart (1809) gives it as a Scotch insect in the neighbourhood of Edinburgh, while G. Don (1813) claims it for the County of Forfar. W. Evans, however, can find no evidence in support of Stewart's and Don's records, except the statement made by James Wilson in the seventh edition of the 'Encyclopædia Britannica' (Entom., p. 158), viz.: "We heard its song near Edinburgh for the first time last summer" (1833).

2. **Gryllus domesticus** Linn.

(Plate XII, figs. 3 and 4.)

domesticus	Linn. Syst. Nat. (ed. x) t. i, p. 428, n. 20	1758—*Gryllus* (*Acheta*).
,,	Linn. Faun. Suec. p. 236, n. 867	1761—*Gryllus*.
domestica	Fabr. Syst. Ent. p. 280, n. 2 .	1775—*Acheta*.
domesticus	White (Gilbert) Nat. Hist. Selborne, Letter xlvii . .	1789—*Gryllus*.
,,	Brunner Prod. der Eur. Orth. p. 432, f. 99	1882—*Gryllus*.
,,	Finot Faune de la Fr. Orth. pp. 237, 239	1889—*Gryllus*.
,,	Eland Shaw Syn. Brit. Orth., in Ent. Mo. Mag., p. 172 .	1890—*Gryllus*.
,,	Burr Brit. Orth. p. 66, pl. v, f. 6	1897—*Gryllus*.
Domesticus	Kirby Syn. Cat. Orth. ii, p. 28 .	1906—*Gryllus*.
domesticus	Burr Syn. Orth. W. Eur. p. 141	1910—*Gryllus*.
,,	Lucas Proc. S. Lond. Ent. Soc. p. 52, pl. vi, f. 2 . . .	1915—*Gryllus*.

Original Description.

domesticus. 20. G. A. thorace rotundato, alis caudatis elytro longioribus, pedibus simplicibus, corpore glauco.

Faun. svec. 620. Gryllus cauda biseta, alis inferioribus acuminatis longioribus, pedibus simplicibus.
Habitat hodie in Europæ *muris domesticis.*
(C. Linnæus, 'Syst. Nat.' ed. x, t. i, p. 428, 1758.)

867. Gryllus *domesticus* thorace rotundato, alis caudatis elytro longioribus, pedibus simplicibus, corpore glabro.
Gryllus cauda biseta, alis inferioribus acuminatis longioribus, pedibus simplicibus. Fn. 620.
Suecis Syrsa.
Hospitatur apud nos in Domibus, ubi in argillaceis muris cuniculos format, et stridule cantillat, præsertim per noctes, inhabitatoribus ingratus; pellitur Nymphææ radice et Populi tremulæ ligno. *It. oel.* 84.
(C. Linnæus, 'Faun. Suec.' p. 236, 1761.)

Male Imago (Pl. XII, fig. 3).—General *colour* yellowish-grey, of a redder tint anteriorly. *Length* up to 18 or 19 mm. *Head* reddish-brown with three dark bands—a curved one between the antennæ, a straight one between the eyes, and a third along the back of the head; *ocelli* in a distinct triangle. *Pronotum* transversely almost rectangular, marked with large dark blotches. *Elytra* not reaching the tip of the abdomen; venation much modified; radial nervure with three branches; a dark streak at the fold between the dorsal and lateral areas. *Wings* fully developed, longer than the abdomen, terminating in rather long "tails." *Hind tibiæ* heavily spined in two rows, in addition to the apical "spurs." *Cerci* long, slender, tapering, hairy.

Female Imago (Pl. XII, fig. 4).—Size and colouring much as in the male. It may be distinguished by the unmodified venation of the elytra and the presence of a long slender ovipositor. The cerci-like "tails" of the wings are somewhat more pronounced than in the male.

Nymph.—Yellowish-grey like the imago; but as in the imago also the tint may be sometimes much darker. It may possess rudimentary alar organs, or be destitute of them, according to age.

Variation.—Though usually rather pale in tint, this is not always the case, individuals occasionally being quite dark. Sometimes the wings are abbreviated and

the tails absent; but this is a very rare form, Brunner having heard of it only from Egypt. Burr found at Radley examples with one wing abbreviated and the other perfectly developed. As the organs of flight may be damaged in combat, a casual examination may sometimes lead to a false conclusion in these and other pugnacious insects.

Date.—Owing to the artificial conditions under which the house-cricket lives in Britain, it has lost touch with the seasons, and examples in all stages of growth may be found together.

Habits, etc.—For the well-being of *G. domesticus* a high temperature seems to be necessary; at any rate it chooses the warmest corners of kitchens and bake-houses for its habitation, and for this reason prefers the bakehouse to the dwelling-house. It feeds on rubbish, refuse, bread, etc., and seems to have a partiality for sweets. To this last liking may perhaps be due the fact that, as Curtis says, "it may be captured, like wasps, by bottles filled with beer." Living in so high a temperature the cricket may be expected to be a thirsty creature, hence perhaps the accusation brought against it of gnawing the wet linen and other materials hung up in the kitchen to dry.

Ray says that both sexes fly with an undulating motion, like the woodpecker's, alternately ascending with expanded wings and descending with folded ones, or, "*volatu undoso*" as Gilbert White says. They sometimes disappear from one house and as suddenly reappear in another, and this migration may have taken place by flight. Crickets, however, burrow in soft mortar (especially in newly-built houses) in order to get from room to room,* and perhaps may by this means sometimes migrate from house to house.

Saussure, Scudder, and others have discussed the means by which crickets produce their well-known chirping. The elytra are elevated so as to form an

* Kirby & Spence, ii, p. 362.

acute angle with the body, and then are rubbed against each other by a horizontal and very brisk motion.* The male imagines only are musical. They are sometimes heard in the daytime, but are most noisy at night, when their monotonous "song" may become very unpleasant. If crickets chirp unusually, wet weather it is said may be expected. Burr heard the chirp of a cricket (which he considered must have been *G. domesticus*) at the bottom of a pit of the coal-mines of Mariemont in Belgium, at a depth of 683 metres (about 2219 feet). The "song" was heard close to the engines only, near the bottom of the shaft.

In connection with the chirping of the house-cricket, F. Milton records† the following interesting occurrence:—"As I was sand-papering some cork for entomological purposes in the quiet hours of the night some time ago, I saw a cricket, *Acheta domestica*, coming towards me. I stopped sand-papering, the cricket stopped; moved, the cricket ran away; resumed my work, the cricket returned. I repeated it two or three times, and at last it came so near to me that I was able to catch it. From this it seems that although crickets have ears, which I understand are situated in the tibia of the front legs, they are not able to distinguish between the noise made by sand-papering cork and that produced by themselves. This is but a single instance it is true."

Gilbert White gives some interesting notes on the house-cricket, of which the following may be quoted‡: "They show a great propensity for liquids, being found frequently drowned in pans of water, milk, broth, or the like. . . . [They are also] very voracious; for they will eat the scummings of pots, and yeast, salt, and crumbs of bread, and any kitchen offal or sweepings. In the summer we have observed them to fly, when it becomes dusk, out of the windows, and over

* Kirby & Spence, ii, p. 392.
† 'Entomologist,' 1895, p. 304.
‡ 'Natural History of Selborne,' letter xlvii, 1789.

the neighbouring roofs. This feat of activity accounts for the sudden manner in which they often leave their haunts, as it does for the method by which they come to houses where they were not known before. . . . When they increase to a great degree, as they did once in the house where I am now writing, they become noisome pests, flying into the candles, and dashing into people's faces; but may be blasted and destroyed by gunpowder discharged into their crevices and crannies. In families, at such times, they are, like Pharaoh's plague of frogs—'in their bedchambers, and upon their beds, and in their ovens, and in their kneeding-troughs.' . . . Cats catch hearth-crickets, and, playing with them as they do with mice, devour them."

Distribution.—*G. domesticus* does not seem at the present time to lead a truly wild life anywhere; in fact its original habitat is uncertain, though probably it was Northern Africa. F. W. Sowerby found it on bare sand in Egypt. It is widely distributed in the Old World, and is also found in North America, though how it reached the New World seems not to be established.

British Localities.

Not a great many records of the occurrence of the house-cricket in the British Isles are to hand. This is possibly due to the fact that most entomologists think it unnecessary to note the presence of an insect which is considered to be ubiquitous. I give below all the records I have met with at various times for the reason that the house-cricket seems undoubtedly to be on the decrease in these islands—perhaps, as some suggest—being gradually displaced by cockroaches.

England. — *Berks:* Neighbourhood of Radley College (*Burr*); Maidenhead (*Hamm*). *Cheshire:* Birkenhead, formerly common in bakehouses where they have now been replaced by cockroaches (*Sopp*); Chester (*Tomlin*); Hoylake and West Kirby, scarce (*Sopp*); Delamere, one captured amongst leaves in the Forest, 1898 (*Sopp*). *Derbyshire:* Common in kitchens and bakehouses in Ashburne district (*Jourdain*); many were to be heard in a field used for tipping the town refuse, near

Ashburne, in the fine weather of June 1904 (*Jourdain*). *Devon:* Generally distributed (*Bignell*); considered general (*Bracken*); Wrangaton 1908 (*de la Garde*); Halsworthy 1912 (*Bracken*). *Essex:* In houses, Walthamstow (*Campion*). *Hants:* Selborne, in the time of Gilbert White evidently common, 1789 (*White*); Winchester (*Chitty*). *Isle of Wight:* Occasionally in houses at Newport and probably throughout the island (*Morey*); frequent in bakehouses, but less common than formerly owing to the improved ovens that have been introduced (*Poole*). *Hertfordshire:* Radlett, a male in a house in November 1915 (*Boycott*); St. Albans, in kitchen at The Grange, 1900 (*Hopkinson*). *Lancashire:* Darwen (*Birks*); Bootle (*Hughmans*); Cartmel (*Sopp*); Liverpool, not so common as formerly (*Sopp*); Manchester (*Chappell*); Rivington Pike, captured in the open (*Harrison*); Southport, common in hothouses in Hesketh Park (*Sopp*). *Lincolnshire:* Caistor, and Bottesford Manor House formerly (*Peacock*); Market Rasen, Louth, and Burgh-on-Bain (*Carter*). *London:* Hoxton, in a bakehouse (*Milton*); Bayswater, in a house (*Pascoe*). *Middlesex:* Teddington 1897 (*Lucas*); Bedford Park, Chiswick ('Entom.,' 1886, p. 66). *Isle of Man:* Laxey 1904 (*Shaw*); Ballaraugh 1904 (*Shaw*); Ballaugh 1904 (*Cassall*). *Norfolk:* (*Edwards*). *Notts:* Nottingham (*Carr*). *Oxon:* Oxford (*Lucas*). *Somerset:* Batheaston (*Blathwayt*). *Staffordshire:* (*Jourdain*). *Suffolk:* Ipswich, bakehouses, etc. (*Morley*); Yarmouth, in some bakehouses very common (*Paget*); Colchester, in a bakehouse (*Harwood*). *Surrey:* Abundant at bakers' shops at East Grinstead (*Burr*); Kingston-on-Thames 1898 (*Lucas*); Bisley 1899 (*Ficklin*); Haslemere, in a bakehouse, 1908 (*Dalgliesh*). *Sussex:* Not uncommon in old houses (*Burr*); Bognor (*Guermonprez*); Shoreham (*Colthrup*); Guestling 1901 (*Bloomfield*); Hastings district, not uncommon in cottages but less common than formerly (*Bloomfield* about 1902). *Yorkshire:* Huddersfield, etc. (*Porritt*).

Scotland.—*Renfrewshire:* A female, Kilbarchan (*Stewart*); Paisley, in mills and bakehouses (*Stewart*). Writing from Paisley 1 September 1902, Stewart says:

"Five or six years ago a colony made its appearance on a moor near here, which had been acquired by the Glasgow Corporation as a dumping ground for the city refuse. They multiplied exceedingly and by the end of the summer to walk over the place was to be "deered" with their whistling. The following winter seems to have killed them all off, as not a whistle has been heard since."

On 25 June 1907 dozens were heard chirping in an old

quarry west of Slateford, near Edinburgh: on 20 July they were again heard. W. Evans then visited the place and found the insects quite numerous, and at all stages from newly-hatched young to full-sized adults. They were living under a layer of rubbish that had from time to time been deposited in the quarry. No doubt the crickets had been introduced with some of this rubbish.

Sibbald (1684) gave *"Grillus Focarius"* (presumably *G. domesticus*) as a Scotch insect; C. Stewart (1809) states that it was to be found in the neighbourhood of Edinburgh; G. Don (1813) says, speaking of Forfarshire, that it was sometimes found near bakers' ovens, but rare. W. Evans (Jan. 1901) says:

"The house cricket is still to be got about bakers' ovens in Edinburgh and other towns, but so far as I can learn it is seldom found in dwelling-houses now. My specimens were taken in a bakehouse in the Newington district of Edinburgh in 1886. Mr. R. Service tells me there are plenty in Dumfries, and Mr. G. Bolam says it occurs in Berwick-on-Tweed, but is not very numerous."

Ireland.—*Donegal:* Coolmore (*fide Kemp*). *Fermanagh:* Belleisle (*fide Kemp*). *Kerry:* Valencia (*Praeger*). *Mayo:* Clare Island (*Praeger*).

Casual Crickets.

Homœgryllus reticulatus Fabr.—A female was found, 18 Oct. 1898, at Kew Gardens in a case from the Belgian Congo State.

Gryllodes (probably **hebræus** Saussure).—Several were taken by G. Massie in the Jodrell Laboratory at Kew Gardens. Apparently they were breeding there.

Gryllodes sp.—One was found at Kew Gardens in a Wardian case from Calcutta in 1899.

Gryllacris sp.—A specimen was found on *Nepenthes* in propagating pits at Kew Gardens, 6 October 1897.

Gryllus bimaculatus de Geer. One was found at the Liverpool Docks in a fruit cargo from Spain (*Sopp*); one, introduced by shipping to Deptford, shown at S. Lond. Ent. and Nat. Hist. Soc. by H. Moore, 24 April 1913

Myrmecophila acervorum Panz.—Westwood recorded this insect as having been taken by Mr. Hope in moss in Archdeacon's Copse near Netley in Shropshire. Further evidence, however, is necessary to confirm it as British. Wasmann records it from North and Central Europe. It lives in ants' nests and therefore could scarcely be a casual. There is no reason why it should not be a British insect, as it would easily escape notice, being but 3·5 mm. long and affecting so retired a habitat. It has been found with *Formica fusca*, *F. sanguinea*, *Lasius niger*, *L. alienus*, *Myrmica lævinodis*, and *Tetramorium cæspitium*.

(**Œcanthus pellucens** Scop.—One was supposed to have been taken by Haworth, near Halvergate in Norfolk. Westwood, however, after purchasing his cabinet, said that the insect had been misnamed. It appears now to be lost.)

Sub-order IV. LOCUSTODEA.
(Long-horned Grasshoppers.)

It is unfortunate that the locusts of ill repute do not belong to the Locustodea, or Long-horned Grasshoppers. The locust-swarms, in fact, which sometimes devastate wide regions in climates warmer than our own, are Short-horned Grasshoppers, and belong therefore to the Acridiodea. There has existed, it must be admitted, a great deal of confusion with regard to the names of the larger divisions of the grasshoppers and crickets, but, according to the arrangement here followed, the colloquial term "locust" does not refer to insects which are included in the group Locustodea. Kirby in his 'Synonymic Catalogue of the Orthoptera' prefers to use for this group the name Phasgonuridæ, and to transfer the name Locustidæ to the Acridiodea, or Short-horned Grasshoppers. Presuming that this system of nomenclature is better, it, on the other hand, has the very great drawback of making "confusion worse confounded."

We may define the Locustodea as: *Orthoptera with hindlegs longer (often much longer) than the forelegs or midlegs, and having the femora swollen at the base; tarsi of four segments; fore tibiæ generally provided with an "ear" situated just below the knee, the "musical" apparatus (when present) being found on the basal part of the elytra of the male; antennæ very long and slender (there being more than thirty segments); ovipositor usually long and sword-shaped; many wingless species.*

Fifteen families are usually given as comprising the Locustodea:—

W.*	1. Stenopalmatidæ.	W.B.	6. Decticidæ.
	2. Gryllacridæ.	W.B.	7. Locustidæ.
	3. Hetrodidæ.	W.	8. Sagidæ.
W.	4. Ephippigeridæ.		9. Tympanophoridæ.
	5. Callimenidæ.	W.B.*	10. Conocephalidæ.

* W = represented in Western Europe; B = represented in the British Isles.

11. Pseudophyllidæ. W.B.
12. Prochilidæ. W.B.
13. Mecopodidæ.
14. Meconemidæ.
15. Phaneropteridæ.

While eight of these families are represented in Western Europe, but five extend so far as the British Isles—Decticidæ, Locustidæ, Conocephalidæ, Meconemidæ, and Phaneropteridæ. Nine species only are known with certainty to be natives of Britain, though *Phaneroptera falcata* Scop. may quite likely turn out to be so. One British species, *Phasgonura viridissima* Linn., finds a place in the typical family. Our nine representatives compare very unfavourably in number with those found in Western Europe, which sum up to over one hundred and sixty. There is apparently only a single reliable record of a locustid from Scotland.

At present I have not met with the eggs of all of our species, but in several cases they may be described as rather long curved cylinders with rounded extremities; those of *Leptophyes punctatissima* Bosc are, however, of quite a different shape. With her formidable scythe-shaped ovipositor the female places the eggs singly, below the surface of the ground in the case of some species, within the twigs or stems of plants in that of others. They are laid in the autumn and apparently hatch in the spring. After some half-a-dozen ecdyses the adult state is reached in the summer—often quite late, and seldom before the latter part of July. There is little post-embryonic development and a pupa-stage is absent, the insects being nymphs from the time of leaving the egg till they become imagines. The wings become more pronounced at each ecdysis after their first appearance; many species, however, remain wingless, or nearly so, throughout their life. As a rule Locustids are sedentary and nocturnal in their habits, as compared with the following group, the Acridians.

While, too, the latter are herbivorous insects, the former are not entirely so, and specimens kept in

captivity often become cannibals. It may even be that some species are regularly carnivorous.

In the Locustodea the vertex of the head is produced

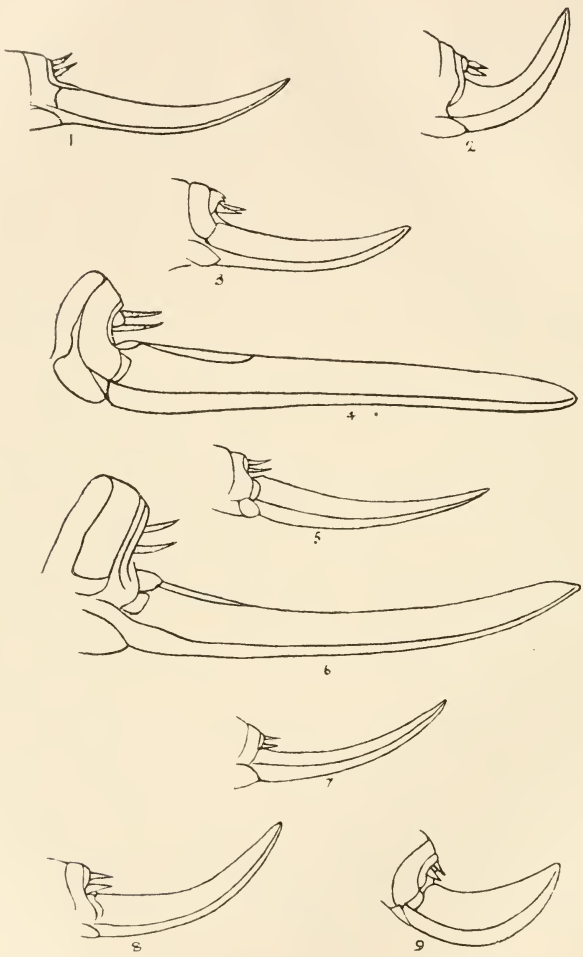


Fig. 19.—Ovipositors of British species of Locustodea, to show relative size and shape (× 3). 1. *Metrioptera brachyptera* Linnæus. 2. *M. roeselii* Hagenbach. 3. *M. albopunctata* Goeze. 4. *Phasgonura viridissima* Linnæus. 5. *Meconema thalassinum* De Geer. 6. *Tettigonia verrucivora* Linnæus. 7. *Conocephalus dorsalis* Latreille. 8. *Pholidoptera griseoaptera* De Geer. 9. *Leptophyes punctatissima* Bosc.

between the swollen bases of the long antennæ to a greater or less extent, and in various forms. The margin of the vertex is separated from the frons by a furrow, immediately below which is the vestige of the median ocellus, the lateral ones being absent.

Of the pronotum the lateral ridges are usually wanting (but may be seen in one or two of our species), and the median one, if present, is not strongly marked. In some cases the side flap runs backwards in a single curve, but in others it is hollowed out at the shoulder. The prosternum may be plain or armed with two spines.

Normally the venation of the elytra is somewhat simple, there being the subcostal nervure, the radius, medius, and cubitus, followed by the first anal nervure, the dividing nervure, and the remaining anal nervures; the anal area beyond the dividing nervure is in the male modified to form a musical apparatus. In this region the left elytron, which at rest overlaps the right, has the nervures thickened, especially below; while in the same part of the right elytron is a bright transparent "speculum"—a vibrating membrane. The rubbing together of the two elytra produces the "song," a kind of file on the left elytron passing across a sharp edge on the right one, and the whole forming a sort of violin. These musical organs are found in the male only, except in two non-British families. In species in which the elytra are greatly reduced, it is these parts which remain. The tympana or "ears" are on the tibiæ of the forelegs. The "song" is more shrill than in the next group, the Acridiodea, in which, too, the sound is produced in a different manner.

Though the British species are easily distinguished without their aid, the number and position (or the absence) of spines on the tibiæ are used in classification, while the presence or absence of apical spurs is important for the same reason. As already mentioned the fore tibiæ of the male bear near their base the tympana, or external "ears," which may be oval,

conchate, or simply a cleft (as in most genera). The mid tibiæ resemble the fore, except for the absence of the tympana. The hind tibiæ have a double row of spines above and below, and the apical spurs below (usually four in number) assist the insect in making its spring, as well as affording a useful point for classificatory purposes. The fore tibiæ may be plain or sulcate: the first and second segments of the tarsi are sulcate, except in *Leptophyes*, so far as British grasshoppers are concerned.

Though colour, size, and wing-development are not good points on which to differentiate species, yet, as our nine natives are easily separated by such means, a table is drawn up on these lines. It must, of course, be used for no other purpose than for identifying the British species.

BRITISH LOCUSTIDS.

A. Wings reduced to vestiges; elytra very small.		
(*a*). Bright green, with minute black spots	*15 mm.	*L. punctatissima.*
(*b*). Ruddy brown	18 mm.	*P. griseoaptera.*
B. Wings and elytra half developed.		
(*a*). Brown, with pale margin *all round* flaps of pronotum	17 mm.	*M. roeselii.*
(*b*). Brown, with pale *hind* margin to flaps.	17 mm.	*M. brachyptera.*
(*c*). Pale green, with crimson-brown dorsal surface; very slender species.	16 mm.	*C. dorsalis.*
C. Wings and elytra fully developed.		
(*a*). Clear green.		
(i). Size small	13 mm.	*M. thalassinum.*
(ii). Size large	33 mm.	*P. viridissima.*
(*b*). Green, with dark spots on elytra	35 mm.	*T. verrucivora.*
(*c*). Brown	21 mm.	*M. albopunctata.*

* Average length of the body of the female from the front of the head to the base of the ovipositor.

Genus 1. **PHOLIDOPTERA** Wesmael.

Pholidoptera Wesmael Bull. Acad. Sc. Brux. v, p. 592 . . 1838.
Micropteryx Stephens Ill. Br. Ent. Mand. vi, p. 12 [name preoccupied] . . . . . 1835.
Olynthoscelis Fischer de Wald. Bull. Soc. Mosc. xii, p. 110 . 1839.
Thamnotrizon Fischer de Wald. Orth. Eur. p. 261 . . . 1853.

Vertex broader than the basal segment of the antennæ. Pronotum more or less produced posteriorly; without carinæ or with lateral carinæ only posteriorly, no median carina; lateral lobes well developed. Prosternum unarmed. Wings abbreviate, the elytra shorter than the body, not passing the end of the abdomen, usually no longer, or even shorter, than the pronotum. Legs moderate, the posterior femora from two to three times as long as the pronotum and usually strongly swollen basally; all the femora unarmed or the posterior ones rarely spinose ventrally; anterior tibiæ armed above on the outer carina only with three spines; posterior tibiæ with four apical spurs beneath; free plantula no longer than the first tarsal segment, sometimes not over half as long. Anal segment of the male rounded posteriorly or acuminately bilobate. Cerci of the male nearly straight, apically somewhat incurved, basally toothed on the inner side; subgenital plate in the male posteriorly subemarginate or deeply incised. Ovipositor sometimes nearly straight but usually curved more or less upwards, acuminate. (A. N. Caudell, 'Genera Insectorum,' fasc. 72, 1908.)

1. **Pholidoptera griseoaptera** De Geer.

(Plate XIV, fig. 4; Pl. XV, figs. 1 and 2.)

griseo-aptera De Geer Mém. Ins. iii, p. 436 . 1773—*Locusta.*
cinereus Gmelin in Linn. Syst. Nat. (ed. 13), i (4), p. 2071, n. 28 . . 1790—*Gryllus.*
clypeata Panzer Faun. Ins. Germ. fasc. 33, pl. iv . . . . . 1796—*Locusta.*
aptera Charp. Hor. Ent. p. 117 . . 1825—*Locusta.*
cinereus Brunner Prod. der Eur. Orth. p. 343 . . . . . 1882—*Thamnotrizon.*

cinereus	Finot Faune de la Fr. Orth. pp. 200, 202	1889—*Thamnotrizon.*
„	Eland Shaw Mon. Brit. Orth., in Ent. Mo. Mag. p. 63 . .	1890—*Thamnotrizon.*
„	Burr Brit. Orth. p. 55, pl. iv. f. 12	1897—*Thamnotrizon.*
„	Lucas Entomologist, p. 290, pl. iii, f. 1	1899—*Thamnotrizon.*
Griseoaptera	Kirby Syn. Cat. Orth. ii, p. 202	1906—*Pholidoptera.*
griseoaptera	Caudell Gen. Ins. fasc. 72, p. 30	1908—*Pholidoptera.*
griseo-aptera	Burr Syn. Orth. W. Eur. p. 106	1910—*Olynthoscelis.*
griseoaptera	Lucas Proc. S. Lond. Ent. Soc. p. 55, pl. i, f. 4. . . .	1914—*Pholidoptera.*

Original Description.

Sauterelle non-ailée grise.

5. *Sauterelle grise sans ailes, avec deux bandes noires sur la tête et le corcelet.*

Locusta (griseo-aptera) *grisea aptera, capite thoraceque fasciis duabus nigris.*

Le 5 Septembre de l'année 1760, je trouvai à Wik, terre seigneuriale près de la ville d'Upsal, des Sauterelles remarquables, un peu plus grandes que celles de l'espece précedente [*Locusta brachyptera*], ayant de très-longues antennes à filets coniques, et la femelle portant au derriere une tariere plus courte que le corps, courbée en-haut et en forme d'une faucille, ou d'une lame de couteau courbée. J'en ai eu des mâles et des femelles.

Les femelles n'ont absolument point d'ailes: car on ne peut gueres donner le nom d'ailes à deux petites lames ovales qu'elles ont derriere le corcelet, une de chaque côté. Les mâles ont de même derriere le corcelet ou sur la poitrine deux piéces applaties membraneuses, qui égalent à peine le tiers de la longueur du corps, et dont l'une est en recouvrement de l'autre. Ces pièces sont équivalantes aux étuis coriaces des autres Sauterelles; celle du dessous est même garnie d'un petit miroir, comme on en voit sur les grandes Sauterelles, et l'autre a plusieurs grosses nervures irrégulieres. On ne trouve point d'ailes en dessous de ces demi-étuis. De chaque côté de la poitrine, près du corcelet, on voit dans l'un et l'autre sexe une grande ouverture ovale, ou une cavité enfoncée dans le corps. La tête n'a point d'yeux lisses.

Tout le corps est gris, mais la tête et le corcelet ont de chaque côté une large bande longitudinale noire, et le dessous du ventre est d'un jaune verdâtre. Dans tout le reste elles sont semblables à celles de l'espece précedente, et leurs cuisses postérieures ont aussi la large bande longitudinale noire. (De Geer, 'Mém. Ins.' iii, p. 436, 1773.)

Male Imago (Pl. XV, fig. 1).—*Colour* greyish-brown, usually with a ruddy blush. *Length* some 15 mm. *Head* large, with dusky markings, rounded on the vertex; *antennæ* hair-like, considerably longer than the body; *pronotum* saddle-shaped, with dark markings on the lateral flaps, flat dorsally, broader posteriorly, finely edged on the lateral and hind margins with a

pale line; *elytra* yellowish, wrinkled, scale-like, not half the length of the abdomen; *wings* absent; fore and mid *legs* of moderate length, hind legs very long (some 43 mm.); *femora* unarmed, mottled, hind ones much swollen at the base; fore *tibiæ* with three spines above, hind tibiæ with four apical spurs below; first *tarsal* segment with pronounced free plantules. *Abdomen* brown above and somewhat mottled, yellow below; *cerci* conical, straight, hairy, with an internal tooth near the base; *subgenital lamina* yellow, *styles* short.

Female Imago (Pl. XV, fig. 2).—Larger (15 to 18 mm.), but in *colour* much resembling the male. *Elytra* lateral, reduced to tiny scales, only just projecting beyond the pronotum; dorsal surface of the *pronotum* more rounded than in the male; posteriorly a median carina indicated (perhaps more clearly than in the male). *Ovipositor* long (9 to 10 mm.), smooth, rather broad, curved well upwards, sharp-pointed.

Nymph.—In appearance much resembling small adults, the elytra-scales gradually developing as the nymphs approach maturity. The colour is perhaps of a rather more uniform greyish tint. Burr remarks that the abdomen is sometimes green.

Variation, etc.—There is some difference in size, though not of a very noticeable character, and occasionally individuals are met with of a rather darker tint than the normal; but the species with us is not a variable one. Bracken took one of a distinctly reddish chestnut colour at Woolacombe in Devon. A male, taken by F. W. Terry near Wimbledon in August 1901, besides the normal pair of auditory organs situated at the basal extremity of the fore tibiæ, had a pair on the mid tibiæ also. Their position and external appearance were quite normal, so presumably they were functional. The abnormality was unnoticed till the insect had been killed, so it was impossible to test its power of responding to sound by means of these additional tympana. Other males appeared to answer one

another's chirpings, so the experiment would have been an interesting one, had it been possible.

Date.—It seems clear that the eggs are laid in the autumn, and hatch the following spring. Indeed on one occasion in October H. Guermonprez found a female laying her eggs in an elm tree at night, with the ovipositor firmly fixed in the trunk. This occurred at Aldwich in Sussex. Nymphs are recorded as having been met with in May, from which time they continue through June and July, and even later. Bracken "swept" newly hatched nymphs from nettles near Plymouth on 10 June 1916. Imagines seem to appear as early as July; they are at their best in August and September, but may continue well into October. Burr speaks of their still chirping near Dover on 21 October 1907.

Habits, etc.—Nettle-beds, coarse herbage, brambles, low bushes—such are the places which these grasshoppers are credited with frequenting. In the New Forest, where I have had many opportunities of observing them, they appear to have a partiality for coarse herbage, especially in grassy rides in the woods. Spots that are somewhat moist seem to be quite as much to their liking as drier places. They are conspicuous insects, with a bulky appearance, and, though wingless, are quite active. When one tries to catch them they hop briskly away, or drop into the herbage out of sight. They are best caught by hand: grassy herbage retards the net, while brambles hold it.

Burr describes the chirp of the male as a short *tss tss*, and says that it is most frequently to be heard after dark—often as late as between 10 and 12 o'clock —on warm August and September evenings, especially before rain. Some naturalists consider the males to be less commonly seen than the females; but, by anyone who is able to stalk them by their chirp, the males may perhaps be more easily caught. They sometimes come to the lepidopterist's "sugar." This habit has been noticed at Torquay (*Porritt* and *Hamm*); in

Bentley Woods, Suffolk (*Morley*); in the New Forest (*Lucas*). It is quite likely, however, that it is not the sugar which attracts them, but its insect visitors; for these grasshoppers, like other Locustids, are well known to be to some extent carnivorous. E. A. Fitch states that three pupæ of *Pyrameis cardui* Linn. were soon devoured by one of these grasshoppers which was introduced into the cage containing them.*

In captivity Burr and Bracken fed *P. griseoaptera* on lettuce, while the latter reared some newly hatched nymphs of this species and of *L. punctatissima* almost to maturity on rose leaves. Owing, however, to their being kept together in confinement, the majority were eaten by their companions. "Long-horned" grasshoppers should always be housed singly; they may then be kept alive for some time. A female of this species, which I brought away from the New Forest at the beginning of September 1909, lived in captivity till October the 6th, when of course it was nearing the natural term of its existence.

It is surprising how much vitality insects sometimes display. On one occasion I had taken some examples of *P. griseoaptera* in the New Forest and wished to preserve them as cabinet specimens. So, after they had been killed as I thought, they were eviscerated in order to preserve their colour, and then set. Several hours later I was startled at finding that two of them were quite alive as regards the anterior parts, one especially so.

Distribution.—*P. griseoaptera* is a common grasshopper in northern and central Europe—England, France, Belgium, Switzerland, Sweden, Lapland. It is less common in the south but occurs in Italy and Spain.

British Localities.

In the south of England this grasshopper is usually considered to be common; personally I have met with it only in the New Forest district, where, however, it is plentiful enough. It is not recorded from Ireland, and but doubt-

* 'Entomologist,' 1879, p. 285.

fully from Wales, though it is probably present in both countries. It has not been met with in Scotland, and apparently does not occur north of the Tweed. Records are:

England.—*Bedfordshire:* Near Bedford (*Porritt*). *Berks:* Near Radley College, Bagley Wood, and Goring (*Burr*); *Bucks:* (*Carrington*). *Cheshire:* A single specimen received from Minshull Vernon in Oct. 1902 (*Sopp*). *Cornwall:* Bracken says it is very common in many places in Devon and Cornwall; fairly common at Widermouth Bay near Bude (*Bracken*); Falmouth (*Shaw*). *Derbyshire:* At Repton Shrubs, but rare (*Brown*). *Devon:* East Lynn River (*Briggs*); Lynmouth (*Champion*); Stoke Woods, Exeter, and Sidmouth (*Rowden*); Bovey Tracey (*Summerson*); Ivybridge (*Bignell*); Haldon (*Parfitt*); near Dartmouth (*Porritt*); Dartmoor (*Shaw*); near Bideford (*Ansorge*); not uncommon near Seaton (*Champion*); Beer (*Lyle*); Torquay and Churston (*Porritt*); Woolacombe (*Bracken*); common near Plymouth (*Bracken*); Westward Ho (*Mead-Waldo*). *Dorset:* Glanvilles Wootton (*Dale*); Bridport (*Shaw*); very common at Broadwindsor near Beaminster (*Jourdain*). *Essex:* near Maldon (*Fitch:* 'Entom.,' 1879, p. 288); Westcliff (*Luvoni*). *Gloucestershire:* (*Edwards*); Wotton (*Perkins*). *Hants:* Common in New Forest (*Lucas*); Fordingbridge (*Lucas*); common at Aldershot (*Sopp*). *Isle of Wight:* Yarmouth (*Stowell*); Sandown (*Holland*); Freshwater, Compton Farm, Blackgang, Undercliff, and Parkhurst Forest (*Burr*). *Herefordshire:* Hereford (*Winston*); Great Doward Hill (*Tomlin*). *Hertfordshire:* Hemel Hempstead (*Gibbs*); Hertford, (*Stephens*). *Kent:* Darenth (*Stephens*); Folkestone (*Briggs*); Chattenden Woods near Strood (*Milton*); Faversham District (*Chitty*); Edenbridge and Eastry, also heard at Fredville, Barfreston, Wingham, Kearsney, and Alkham (*Burr*); Stonehall (*Porritt*); Dartford (*West*); Bostal Heath (*Shaw*); Plumstead (*Shaw*). *Lincolnshire:* Hangham Pasture, abundant (*Wallis Kew*); Linwood near Louth (*Goulding*). *Middlesex:* Acton, 1885 (*Winston*); Wormwood Scrubs (*Shaw*). *Monmouthshire:* near Chepstow (*Burkill*). *Norfolk:* (*Edwards*). *Oxon:* Oxford (*Xiphidium clypeatum* in Prof. Westwood's Garden, 1876). *Somerset:* Combre Florey near Taunton, very common (*Jones*); Batheaston (*Blathwayt*). *Suffolk:* Bungay Common (*Tuck*); Wherstead (*Morley*); *Acrida aptera*, at Lound Wood near Yarmouth (*Paget*); Bentley Woods (*Morley*); Colchester (*Harwood*). *Surrey:* Bellagio near East Grinstead (*Burr*); common at Farnham (*Sopp*); Hale (*Sopp*); near Wimbledon, 1901 (*Terry*); Lingfield

(*Burr*); Surbiton (*Burr*). *Sussex:* Guestling (*Bloomfield*); Lewes, Chailey (*McLachlan*); Eastbourne (*Winston*); Aldwich; Bognor and District (*Guermonprez*); Ashdown Forest (*Burr*); Slindon (*Guermonprez*); East Grinstead (*Burr*). *Wilts:* West Wood near Marlborough (*Stowell*).

Wales.—In the Cambridge University Museum are specimens labelled "Raglan (*Perkins*); Gower vi. 97." Presumably these are Welsh examples.

Genus 2. **METRIOPTERA** Wesmael.

Metrioptera. Wesmael Bull. Acad. Sc. Brux. vol. v, p. 592 . 1838.
Platycleis Fieber in Kelch, Grundl. Kenntn. Orthopt. p. 2 . 1852.
Chelidoptera Wesmael Bull. Acad. Sc. Brux. vol. v, p. 591 . 1838.

Vertex broad. Pronotum rounded above or flat, with or without carinæ, the lateral ones, when present, dull and nearly straight or bowed outwards posteriorly; lateral lobes well developed. Prosternum unarmed. Organs of flight fully developed or abbreviated, the elytra ranging from as long as the pronotum, rarely less, to much longer than the body. Legs variable in length, the posterior femora two and a half times as long as the pronotum, or longer; all the femora unarmed; anterior tibiæ armed above, on the outer side only, with three spines; posterior tibiæ with four apical spurs below; free plantula sometimes as long, or nearly as long, as the first segment of the tarsi, but usually not more than half as long. Cerci of the male armed with a tooth on the inner side at the base or before the middle. Ovipositor usually somewhat curved upwards, sometimes nearly straight, pointed, apically smooth or finely crenulate. (A. N. Caudell.)

Type of the genus *Metrioptera brachyptera* Linn.

Table of the British Species.

1. Elytra and wings fully developed . . *M. albopunctata.*
2. Elytra abbreviated; wings vestigial.
   (*a*). Pale *posterior* margin to lateral flap of pronotum; ovipositor 9 mm. . . . . *M. brachyptera.*
   (*b*). Pale margin *all round* flap of pronotum; ovipositor 6 mm. . *M. roeselii.*

1. **Metrioptera albopunctata** Goeze.

(Plate XIV, fig. 8; Pl. XVI, fig. 3.)

albopunctatus	Goeze Ent. Beytr. ii, p. 89, n. 1 .	1778—*Tettigonia.*
grisea	Fabr. Spec. Ins. i, p. 359, n. 22 .	1781—*Locusta.*
griseus	Serv. Ins. Orth. p. 488 . .	1839—*Decticus.*
,,	Fieb. Kelch. Kenntn. Orth. p. 2.	1852—*Platycleis.*
grisea	Brunner Prod. der Eur. Orth. p. 347	1882—*Platycleis.*
,,	Finot Faune de la Fr. Orth. pp. 204, 205	1889—*Platycleis.*
,,	Eland Shaw Mon. Brit. Orth., in Ent. Mo. Mag. p. 94 . .	1890—*Platycleis.*
,,	Burr Brit. Orth. p. 57, pl. iv, f. 13	1897—*Platycleis.*
Albopunctata	Kirby Syn. Cat. Orth. ii, p. 203.	1906—*Chelidoptera.*
albopunctata	Caudell Gen. Ins. fasc. 72, p. 31	1908—*Metrioptera.*
grisea	Burr Syn. Orth. W. Eur. p. 109	1910—*Platycleis.*
albopunctata	Lucas Proc. S. Lond. Ent. Soc. p. 55, pl. i, f. 8	1914—*Metrioptera.*

(Other synonyms:—*L. striata* Thunb.; *L. denticulata* Panz.; *L. falcata* Zett.)

Original Description.

IV. Tettigonia, Säbelschwänze.

1. *Albo-punctatus*, der *Weisspunkt.*
Rösels Insektenbel. 2. B. Samml. der Heuschr. p. 128, t. 20 ff. 8, 9, 10.
Feminæ corpus viridescens; *mas* fusco-testaceus; *elytris* flavo-marginatis et maculatis; in femorum junctura *punctum albissimum.*
(Goeze, 'Ent. Beytr.' ii, p. 89 (1778).)

Male Imago (Pl. XVI, fig. 3).—*Colour* rather bright brown, mottled and spotted with very dark brown: for a day or two after reaching maturity a green tint may remain upon the sides, and Goeze's description (above) of the female seems to have been made from such a specimen. *Length* some 18 mm. The slender *antennæ* longer than the body. Side flaps of the *pronotum* sometimes edged with a paler tint, dimly suggesting the margin in *M. roeselii*. *Elytra* narrow, but fully developed, pale brown with darker markings. *Wings* fully developed, nearly hyaline, with brown nervures. *Hind legs* about three times as long as the fore legs, femora much swollen at the base and marked there with a dark patch. *Thoraæ* (as well as abdomen) pale below. *Anal segment* deeply furrowed, lobes pointed. *Cerci*

pointed, conical, hairy, with a tooth nearer the apex than the middle. *Subgenital lamina* emarginate, styles rather long.

Female Imago (Pl. XIV, fig. 8).—*Elytra* and *wings* fully developed as in the male. *Colouring* as in the male. *Length* some 21 mm. *Subgenital lamina* emarginate with rounded lobes. *Cerci* without a tooth. *Ovipositor* 9 mm. from base to tip, shining, curved somewhat upwards, pale at the base but very dark for the most part, finely crenulated below towards the apex.

Egg (fig. 20).—H. M. Edelsten, when "sugaring" at Dartmouth on one occasion, found a female *M. albopunctata* laying eggs in one of the posts, with its ovipositor thrust deeply into a chink in the wood. He

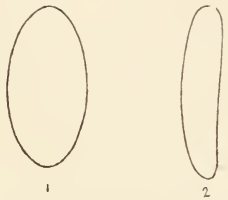


Fig. 20.—Egg of (1) *Leptophyes punctatissima* Bosc (× 6); (2) *Metrioptera albopunctata* Goeze (× 6).

very aptly remarked: "What curious black cigar-shaped things the eggs are!" They are really a little curved — sausage-shaped. Those I possess were extracted from females and are practically black in colour (dull yellow when immature), while the surface is finely granulated. The length is 4 mm. and the breadth about 0·8 mm.

Nymph.—Brunner describes the nymph (evidently when approaching maturity) as greenish, pronotum crimson (*purpureum*), lateral flaps green, elytra with two large black spots, posterior femora and ventral surface of abdomen bright green. After the final ecdysis the green colour on the sides is evident for two or three days.

Variation.—Bracken took a pale example on the

sand-dunes at Braunton Burrows, which he contrasts with a dark specimen from cliffs in another locality. Edelsten notes a female at Dartmouth with the top of its head and the plate on the thorax quite red, and I have taken a female with the dorsal surface of head and thorax rust-coloured. If a series of British examples is examined a little variation in the length of the elytra will be noticed. The species with us, however, does not appear to vary to any extent.

Date.—Eggs are laid in the autumn and hatch in the spring. Nymphs are found in the early summer and imagines in the late summer and autumn. Stephens mentions the occurrence of specimens at Dover at the end of July, but does not say whether they were mature or not. Judging by the records August and September seem to be the best months for imagines, though they may live on into October, Morley having met with the species in Sussex on the 11th of that month in 1894. Nymphs sometimes occur very late: I took one on 26 August 1903 on the Hampshire coast, while Burr found female nymphs as late as 8 September in 1896, at Folkestone Warren.

Habits.—In England this grasshopper seems to have a liking for barren uncultivated spots especially on a chalky hillside; but it is not confined to such places, being found on cliffs on sandy soil near Plymouth, and on sand-dunes at Sandwich, while Burr found it plentiful on the outcrop of the Greensand at Compton Bay in the Isle of Wight. It has been spoken of more than once as connected with the rest-harrow (*Ononis spinosa* Linn.); but it remains to be seen whether or not this is an accidental association. Amongst rough herbage on a cliff-side in the south of England *M. albopunctata* may be expected. I have once or twice noticed that it occurred on a damp clayey spot, where the surface of the cliff was breaking away or sliding downwards. Morley found it on plants on the Sussex coast. It has been taken at "sugar"—at Torquay (*Hamm* and *Bracken*) and at Dartmouth (*Edelsten*).

This is a very active creature, which when disturbed tries to hide amongst the rough vegetation, where it is not easily found, for its colouring assimilates extremely well with such surroundings. Burr found *M. albopunctata* easy to keep in confinement, and that it ate flies greedily. In 1896 he remarked that he had never heard the species chirp. On the surface of soft sand it is almost helpless, leaping apparently being impossible.

Distribution.—This Locustid is found practically throughout Europe—England, Holland, Belgium, France, Switzerland, Sweden, Spain, Italy, and Montenegro at the least—as well as in Asia Minor, Syria, the Caucasus, and Madeira.

British Localities.

M. albopunctata occurs in all the counties of the south coast of England, while there is one record for Suffolk, and, rather strangely, one from the inland county of Derby. Records are :

England.—*Cornwall :* Tregantle near Plymouth (*Bracken*) ; Land's End (*Burr*) ; common at Fowey (*Stowell*). *Devon :* Torquay, Whitsands near Plymouth, and one at Braunton Burrows (*Bracken*) ; Dartmouth (*Edelsten*) ; Dawlish (*Babbington*—Stephens' Illus.). *Dorset :* Chapman's Pool, and coast between Lulworth and Weymouth (*Lucas*) ; Charmouth (*Burr*) ; Isle of Portland (*C. W. Dale*). *Hants :* Coast near Milton, and near Mudeford (*Lucas*) ; Barton (*Edwards*) ; Hayling Island, Southsea, and Southampton (*Burr*). *Isle of Wight :* Compton Bay (*Porritt*) ; common at the Undercliff and Blackgang (*Burr*). *Sussex :* Southwick Beach (*Morley*) ; Hastings, on the hill above the town (*Saunders*). *Kent :* Folkestone (*Briggs* and *Burr*) ; Deal and Sandwich Bay (*Burr*) ; St. Margaret's Bay (*Chitty*) ; beneath cliffs at Dover (*Stephens*). *Suffolk :* Colchester (*Harwood*). *Derbyshire :* Near Derby : specimens now in Derby Museum (*Pullen*).

2. **Metrioptera brachyptera** Linn.

(Plate XIV, fig. 7 ; Pl. XVI, fig. 2.)

brachypterus Linn. Faun. Suec. (ed. 2), p. 237, n. 868 . . . . . 1761—*Gryllus.*

brachyptera De Geer Mém. Ins. iii, pp. 433–434, n. 4, pl. xxii, ff. 2, 3 . . 1773—*Locusta.*

brachyptera	Latr. Cuv. Règne Anim. (ed. 2), v, p. 184 note	1829—*Anisoptera.*
,,	Steph. Ill. Br. Ent. Mand. vi, p. 13, n. 3	1835—*Micropteryx.*
brachypterus	Burm. Hand. ii, p. 711, n. 7 . .	1838—*Decticus.*
,,	Fieb. Kelch. Kenntn. Orth. p. 2, n. 4	1852—*Platycleis.*
brachyptera	Brunner Prod. der Eur. Orth. p. 356	1882—*Platycleis.*
,,	Finot Faune de la France, Orth. pp. 204, 208	1889—*Platycleis.*
,,	Eland Shaw Mon. Br. Orth., in Ent. Mo. Mag. p. 95	1890—*Platycleis.*
,,	Burr Brit. Orth. p. 57, pl. v, f. 1	1897—*Platycleis.*
Brachyptera	Kirby Syn. Cat. Orth. p. 209 .	1906—*Chelidoptera.*
brachyptera	Caudell Gen. Ins. Fasc. 72, p. 31	1908—*Metrioptera.*
,,	Burr Syn. Orth. W. Eur. p. 112 .	1910—*Platycleis.*
,,	Lucas Proc. S. Lond. Ent. Soc. p. 55, pl. i, f. 7; pl. iii, f. i . .	1914—*Metrioptera.*

(Other synonyms: *P. alpinus* Fieb.; *L. marginata* Thunb., var.; *P. brachyptera*, var. *macroptera* Stål.)

Original Description.

868. GRYLLUS *brachypterus* griseo-fuscus, elytris alisque corpore dimidio brevioribus.
Habitat in Suecia, De Geer.
Descr.: *Thorax* latere postico utrinque linea alba terminatus. *Totus* virescens. *Femora* linea longitudinali nigra. *Alæ* elytris, elytra abdomine breviora. *Ensis* adscendens.
(C. Linnæus, 'Faun. Suec.,' p. 237, 1761.)

Male Imago (Pl. XVI, fig. 2).—*Colour* in general dark brown with darker markings, variegated with green. *Length* 16 mm. *Head* having at the top a broad longitudinal pale (sometimes greenish) band, stretching back to the pronotum, and edged with a wide black stripe. *Antennæ* very slender, longer than the body. *Pronotum* flat, with a median carina posteriorly, usually dark green dorsally; a broad pale yellowish band along the hind margin of the dark side-flap. *Elytra* shorter than the abdomen, pointed, grey-brown with front and hind margins green; "musical" apparatus distinctly provided for on the part of the elytra remaining; *wings* minute—quite vestigial. *Femora* with black dots, the swollen base of the hind ones greenish below, and having a longitudinal black streak on both aspects. *Abdomen* yellow

below. Anal segment emarginate at hind edge with lobes rather sharp-pointed. *Cerci* stout at base, a prominent tooth about the middle internally, slender beyond the tooth. *Subgenital lamina* long, pale, with a median carina, emarginate; styles moderate in length.

Female Imago (Pl. XIV, fig. 7).—Very closely resembling the male in general, but a little larger. *Elytra* not modified to form a "musical" apparatus. *Cerci* not toothed. *Subgenital lamina* with a small posterior notch. *Ovipositor* long—about 10 mm., shining, getting darker in colour from base to tip, where it is very slightly crenulated, only gradually curved on both edges.

Eggs.—Closely resembling those of *M. albopunctata*, but perhaps a little more slender; about 4 mm. long by 1 mm. broad; very dark brown; cigar-shaped with a slight curve. (Extracted from the body of a female.)

Nymph.—Except for the smaller size, and the absence or still greater abbreviation of the elytra, the nymph closely resembles the imago especially in the case of the female, whose ovipositor appears disproportionately long.

Variation.—There is a very scarce variety in which the organs of flight are perfectly developed, but it has not yet been recorded for Britain. A fairly common form has the green parts of the elytra replaced by grey-brown, a change which considerably alters the appearance of the insect. Occasionally the pale posterior margin of the side-flap of the pronotum is continued faintly all round, in which case a hurried determination might cause a false record of *M. roeselii*.

Date.—Eggs, which are laid in the autumn, hatch in the spring. The earliest records of capture I have are 1 July (Oxshott, *R. South*), 19 July (Ashdown Forest), and 29 July (Cumberland); but whether the insects were mature, or not, I cannot say. My latest capture took place on 24 October in

1897 on Esher Common, Surrey. August and September are the best months for imagines.

Habits, etc.—In my own experience *M. brachyptera* inhabits heathy ground, but affects by preference moist spots, or even the surface of bogs. It should therefore be looked for amongst the cross-leaved heath (*Erica tetralix*) rather than those species which prefer drier ground. In such spots the vegetation is often rank and luxuriant. Consequently, although this grasshopper is not particularly active, its capture requires patience. After a hop or two it often takes refuge and hides at the base of the herbage. At times its mode of progression partakes more of the nature of a walk or a run than of a hop. The species is easily noticed "in the field," as, in the living insect, the green parts of its colour-pattern show up rather clearly.

If several are kept together in captivity, they must be well supplied with food, or they will probably turn cannibal. About 6 October 1905 one of two caught near Oxshott, Surrey, and kept in a glass-bottomed box, partly devoured the other. Whether the victim became moribund, or whether it was forcibly overcome by its companion, I cannot say; but, as was clear from the movements of its jaws, it was not lifeless while the other was feeding upon it. Grass had been supplied to them, but it soon became dry, and hunger probably induced the cannibalism. H. Campion relates a similar experience. Of two also obtained at Oxshott (1 July 1911), one cast its skin in a glass-bottomed box, and later made a meal of the skin. For some days they were kept in a fish-globe with a *Gomphocerus maculatus*, also from Oxshott. The *G. maculatus* looked a little sluggish one night, and the next morning was dead, and one of the Locustids was feeding upon it. As an instance of the vitality displayed by a female of this species the following may be mentioned. Two, a male and a female, taken on Esher Common, after being in a cyanide-bottle for a short time, were placed

in a tin box. The female recovered, and a day or two afterwards was found to be quite lively, with the dead body of the male partly devoured.

Distribution.—From Lapland in the north to the Alps in the south, and from the west to the Ural Mountains in the east. It has also been found in Amur.

British Localities.

England is the only part of the British Isles from which *M. brachyptera* has been reported. Here in a few counties it is found, these being usually in the south. It is a local insect, but sometimes common where it occurs.

England. — *Berks:* (*Hamm*). *Bucks:* East Burnham Common (*Campion*). *Cornwall:* Quintrell Downs, Newquay (*Edwards*). *Cumberland:* Salkeld; not uncommon on one of the low fells in south-east Cumberland on heathy ground (*Day*). *Derbyshire:* ? at Repton Shrubs (*Brown*). *Devon:* Haldon and Woodbury Common (*Parfitt*). *Dorset:* Purbeck Heaths (*C. W. Dale*). *Hants:* New Forest, common (*Lucas*); Bournemouth (*Porritt*); in numbers (1903) at St. Catherine's Hill at the back of Christchurch (*Burr*). *Kent:* Between Walmer and Dover (*Lucas*); Darenth Wood (*Stephens*); Broadwater Down, Tunbridge Wells (*Guermonprez*). *Norfolk:* King's Lynn (*Atmore*). *Surrey:* Wisley and Leith Hill (*Briggs*), Esher Common, Oxshott Heath, and Woking (*Lucas*); Witley (*Dalgliesh*); Frensham Heath (*Sopp*); Coombe Wood and near Ripley (*Stephens*). *Sussex:* Bexhill (*Butler*); cliffs at Hastings (*Guermonprez*); Ashdown Forest (*Burr*). *Yorkshire:* Thorne Moor and Stensall Common (*Porritt*).

3. **Metrioptera roeselii** Hagenbach.

(Plate XIV, fig. 9; Pl. XVI, fig. 1.)

roeselii	Hagenb. Symb. Faun. Ins. Helv. i, p. 39, f. 24	1822—*Locusta.*
brevipennis	Charp. Horæ Ent. p. 114 . .	1825—*Locusta.*
roeselii	Steph. Ill. Br. Ins. Mand. vi, p. 13, n. 2	1835—*Micropteryx.*
Roeselii	Brunner Prod. der Eur. Orth. p. 358	1882—*Platycleis.*
roeselii	Finot Faune de la Fr., Orth. pp. 205, 209	1889—*Platycleis.*

Roeselii	Eland Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 96 . . .	1890—*Platycleis.*
roeselii	Burr Brit. Orth. p. 58, pl. v, f. 2 .	1897—*Platycleis.*
Roeselii	Kirby Syn. Cat. Orth. p. 210 .	1906—*Chelidoptera.*
roeselii	Caudell Gen. Ins. Fasc. 72, p. 32	1908—*Metrioptera.*
„	Burr Syn. Orth. W. Eur. p. 113 .	1910—*Platycleis.*
„	Campion Entom. xlv, p. 117; xlvi, p. 37	1912–3—*Metrioptera.*
„	Lucas Proc. S. Lond. Ent. Soc. p. 56, pl. i, f. 9	1914—*Metrioptera.*

(Other synonyms: *P. roeseli* Bol.; *D. sinuatus* Fisch.; *L. diluta* Charp. var.; *D. pellucida* Herr.-Schäff.; *P. roeselii* var. *macroptera* Brunn.; *P. roeselii* var. *bispina* Bol.)

Original Description.

Fig. 24.

Locusta roeselii.

Nova species.

L. viridis vel grisea, thoracis dorso plano, subtricarinato, lateribus flavo-marginato, hemelytris abdominalis tertiam partem aequantibus griseis, femoribus posticis vitta longitudinali dentata atra, ensi minuto subrecurvo.

Roesel Insectenbel. Tom. 2, Tab. 20, fig. 9.

Habitat Basileae.

[A long description in Latin follows this diagnosis.]

(Hagenbach, 'Symb. Faun. Ins. Helv.,' p. 39, 1822.)

Male Imago (Pl. XVI, fig. 1).—General *colour* of matured adult brown, variegated with green, especially in specimens which have recently passed through the last ecdysis. Length 16 mm. *Head* ash-coloured; *vertex* very broad, edged with black, and having a central longitudinal fine pale line on each side of which is a fine darker line; the long slender antennæ light brown. *Pronotum* with the brown disc broad and flat, the dark side-flaps edged "all round" with a pale greenish or yellowish border. *Elytra* abbreviated (not so long as the abdomen), somewhat rectangular in shape, truncated behind, in colour pale greenish brown with dark brown nervures. *Wings* minute (about 2·5 mm. long), even more vestigial than in *M. brachyptera*. *Legs* brown, sometimes with a green tinge in places, hind femora with a broad dark streak on the swollen part. Sides of thorax and abdomen with a row of yellow markings; dorsal surface of abdomen

brown, ventral yellow. *Anal segment* excavated, emarginate, lobes produced. *Cerci* rather slender, a pronounced tooth nearer the apex than the base. *Subgenital lamina* pale, slightly concave, acutely emarginate, with a median carina, styles rather prominent.

Female Imago (Pl. XIV, fig. 9).—In *colour* much as in the male, in *size* a little larger. *Elytra* smaller, veining simpler; *wings* as small as in the male. *Subgenital lamina* pale, deeply emarginate. *Ovipositor* short (about 7 mm. long), turned sharply upwards, lower edge gently curved, upper nearly straight, getting darker from base to tip which is slightly crenulated along the edges, shining. *Cerci* without teeth.

Eggs.—In shape a curved cylinder with bluntly-rounded ends; about 4·25 mm. long by ·75 mm. broad; brown; finely but regularly granulated. (Extracted from the body of a female sent alive from Trusthorpe in 1912.)

Variation.—Very rarely the organs of flight are fully developed, but no instance has been noticed in Britain. In coloration, that of the male appears to be more constant than that of the female. The most variable parts are the spots on the sides of thorax and abdomen and the border of the side-flaps of the pronotum: these may be light green, bright yellow, or some intermediate tint. In some cases the median longitudinal light line on the vertex of the head is not evident: when present this may, or may not, be continued on the pronotum. In some females bright green is conspicuous in their scheme of coloration; in others the colour as a whole is bright brown, the tint of which may vary.

Nymph.—Two dried examples that I possess, except for the smaller size and less developed organs of flight, much resemble the adult form; but nymphal grasshoppers alter in drying much more than do the adults. A female nymph taken by Luvoni on 28 August was very green indeed, and a brighter green tint seems to

be a sign of the "teneral" condition in imago, as well as in nymph. Porritt mentions the green tint of specimens he took at Trusthorpe in 1912, and this may perhaps have been due to retarded colour-change owing to the unsummerlike weather of that year. Guermonprez showed Burr a very young Locustid nymph from Par in Cornwall. The pale border showed up distinctly, but the pale border is more conspicuous in *M. albopunctata* in the nymphal stage, and I believe this is the case in *M. brachyptera* also. It would, therefore, be unwise to assign to this species all nymphs with pale border all round the flaps of the pronotum.

Date.—It may safely be assumed that the eggs laid in the autumn hatch in the following spring. Nymphs have been observed on 24 June (*Harwood*); and a female, still not adult, was taken by A. Luvoni on 28 August. H. Campion records imagines on 21 July, and the capture of two males on 22 September. One of these last survived in captivity till 28 September and the other till 12 October.

Habits, etc.—So few are the known localities for this grasshopper in England, that it is not easy to say exactly what its predilections are as regards a suitable haunt. One of its known habitats is amongst coarse grass on sandhills (*Porritt*); another is amongst long grass at the foot of a sea-wall (*South*); a reed-patch on the shore of the Thames estuary (*West*) is a third; while a fourth is a sunny, grassy hill-side, overgrown with thistles, ragwort, and other plants (*Campion*). Burr considers rank vegetation in damp fields, and herbage, favourite spots for the species. Campion has kept both males and females alive in captivity for two or three weeks, feeding them on fresh grass, of which they ate greedily while it remained fresh. All the specimens that he had under observation were kept indoors in large dry fish-globes. More than once he found that dead, or dying, examples were partly eaten by their companions. This cannibalistic

tendency is, however, not uncommon amongst Locustids. While under observation he found, as a general rule, a tendency for the green coloured parts to change to yellow or light brown. The pale margin of the lateral flaps of the pronotum shared in this change, and the transition from green to yellow in all cases progressed from the posterior margin forwards. This observation seems to reconcile the discrepancy with regard to the coloration of the margin as given by various authors, and the colour found by Porritt to be universal in his Trusthorpe specimens of 1912. One which he sent me alive from that locality still has the margin of a greenish tinge although it is now nearly six years old.

Distribution.—*M. roeselii* is chiefly European, its distribution being somewhat similar to that of *M. brachyptera*: apparently, however, it is less frequent in the north but extends farther south. On the Continent it is not purely littoral as it appears to be in England. It has been mentioned as present in Sweden (?), Denmark, England, France, Belgium, S. Germany, Italy, Croatia, Istria, Servia, Bosnia, Herzegovina, Spain (?), Caucasus. Perhaps it crosses the Ural Mountains.

British Localities.

In Britain so far as at present known this species is confined to the south-east coast of England, and till a few years ago was almost lost to sight. Even now recorded localities for it are extremely few.

Stephens says: "This species appears to be very rare in this country. I have hitherto seen, so far as I remember, two examples only, which are in my own collection, and were found in the vicinity of the Metropolis in the autumn, I believe at *Hampstead*."*

In 1886 E. Saunders took one at *Herne Bay* in August.

In August 1888 it was found plentifully by H. Wallis Kew amongst coarse grass "along by the footpath" on the sand-hills at *Trusthorpe*, between Mablethorpe and Sutton-on-Sea in Lincolnshire.

* 'Ill. Br. Ent. Mand.' vi, p. 13, 1835.

Next follows a male from a field at *Herne Bay*, probably the locality in which Saunders took it. It is in H. Guermonprez' collection. This record appears to be undated.*

On 8 April 1912 B. S. Harwood sent me a male for purposes of identification, and afterwards gave it to me. It and others were taken on the *Essex coast*. He apparently saw it first in 1903 (the specimen sent was dated 3 Sept. 1903), and took a few only during the years till 1910, when he saw perhaps a dozen nymphs and took several adults. He also took one in 1911. On 15 April 1912 he said: "I have three or four more males and two or three females and have sent several away as *brachyptera*." In 1912 Harwood noticed nymphs on 24 June and captured four adult females on 7 September. One of these females he added to my collection.

On 13 September 1907 Campion took a female at *Herne Bay;* but he could not find the species there in September 1908.

On 1 August 1911 South took a male at *Leigh* in Essex.

On 3 September 1911 W. West captured five males and two females on the bank of the Thames a few miles *below Gravesend*. Two pairs were placed in his own collection, the odd specimen he gave to me.

From 21 July to 22 September 1912 examples were taken at *Westcliff* and *Canvey Island*, thus adding two new localities to the list, A. Luvoni being the fortunate discoverer.

In August 1912 Campion was again able to take a few specimens at *Herne Bay*.†

On 22 August 1912 West took a female *near Gravesend* and gave it to me.

In 1912 Porritt visited Kew's old locality at *Trusthorpe* to see if *M. roeselii* was still to be found there. He was in the locality from 27 August till 9 September. His visit commenced the day after the great floods in Norfolk and Lincolnshire, due to the long-continued torrential rains. Although during his stay there was comparatively little rain, the ground for some days was in many places a veritable swamp, and the wind day after day blew with such violence from the north and east, and was so bitterly cold, that collecting was as unprofitable as it was uncomfortable. *M. roeselii* seemed to be exceedingly local, being apparently almost confined to a stretch of the sandhills, about 100 yards long by 10 or 12 yards wide, on the land side. Although he carefully examined many

* 'Entomologist,' 1897, p. 28.

† About 1887 C. O. Waterhouse took 5 males, 2 females, and a female nymph at Herne Bay, mostly in July. 'Entomologist,' 1912, p. 118.

other places to all appearance exactly similar, he could find no trace of it elsewhere. It occurred amongst the long rank grasses, from the base to ten or a dozen yards up the steep side of the sandhills. The bright green border of the side-flap of the pronotum was most conspicuous as soon as the insect was seen at all. In many specimens there was a good deal of green about the femora, etc., although in others these parts were brown. Indeed the living insect is far more distinct from *M. brachyptera* than the descriptions seem to indicate. Writing 10 September 1912 Porritt said: "I send you a living specimen of *P. roeselii* which I took at Trusthorpe on 9 Sept. During the past fortnight I took three dozen there, notwithstanding atrocious entomological weather. All my specimens, without exception, had the semicircular border round the side flap of the bright grass-green colour of this specimen, whereas all descriptions of it I have seen give the colour as yellowish or yellowish-white. No doubt that idea has been got from dried or set specimens, as I find the colour soon goes after the death of the insect, and in some of the earliest-caught specimens on the setting-boards the green has already quite faded away. The colour in other respects, as you will see, is also slightly different from that of the published descriptions. I managed to find only two specimens yesterday morning in the strong wintry gale blowing, one of which I now send to you."

It will be seen that all the British examples have been taken about the mouth of the Thames, or on the east coast south of the Humber, if we omit a doubtful nymph in Guermonprez' collection from Par in Cornwall.

Genus 3. **TETTIGONIA** Linn.

Gryllus Tettigonia Linn. Syst. Nat. (10) vol. i. p. 429 . . . 1758.
Decticus Serville Ann. Sc. Nat. vol. 22. p. 155 . . . . 1831.

Linnæus divides his genus *Gryllus* into six sub-genera, one of which, *Tettigonia*, with seventeen species, he characterises as: "Cauda ensifera feminis."

More clearly diagnosed the genus is as follows:— Vertex broad. Pronotum unarmed, with or without carinæ. Organs of flight fully developed, the elytra usually twice as long as the pronotum, or more. Legs long, the hind femora very long and much swollen at the base. Fore tibiæ armed above on the outer side

with four spines, the hind tibiæ with four spurs beneath at the apex; free plantules shorter than the basal segment of the tarsus. Anal segment of the male excavate; the cerci in the same sex bearing an internal tooth. Ovipositor curved very gradually upwards. Type of the genus *Gryllus Tettigonia verrucivora* Linnæus.

1. **Tettigonia verrucivora** Linn.

(Plate XIV, fig. 2; Pl. XVII, fig. 1.)

verrucivorus	Linn. Syst. Nat. (ed. x), i, p. 431, n. 38 . . .	1758—*Gryllus Tettigonia.*
,,	Linn. Faun. Suec. (ed. ii), p. 237, n. 870 . . .	1761—*Gryllus.*
verrucivora	De Geer Mém. Ins. iii, p. 430, n. 2, pl. xxi, ff. 1, 2 .	1773—*Locusta.*
Bingleii (var.)	Curtis Brit. Ent. ii, pl. lxxxii	1825—*Acrida.*
verrucivorus	Serv. Ann. Sci. Nat. xxii, p. 155	1831—*Decticus.*
verrucivora	Duncan Jardine's Nat. Libr., Ins. i, p. 253, pl. xiii, f. 2	1840—*Acrida.*
verrucivorus	Brunner Prod. Eur. Orth. p. 363, f. 88	1882—*Decticus.*
,,	Finot, Faune de la Fr., Orth. p. 213, pl. xi, f. 144	1889—*Decticus.*
,,	Eland Shaw Mon. Brit. Orth., in Ent. Mo. Mag. p. 96	1890—*Decticus.*
,,	Burr Brit. Orth. p. 59, pl. v, f. 3	1897—*Decticus.*
,,	(var. *buyssoni*) Azam Rev. Sci. Bourbonn. xv, p. 39	1902—*Decticus.*
Verrucivora	Kirby Syn. Cat. Orth. p. 213	1906—*Tettigonia.*
verrucivora	Caudell Gen. Ins. Fasc. 72, p. 28	1908—*Tettigonia.*
verrucivorus	Burr Syn. Orth. W. Eur. p. 114	1910—*Decticus.*
verrucivora	Lucas Proc. S. Lond. Ent. Soc. p. 54, pl. i, f. 2 .	1914—*Tettigonia.*

Original Description.

verrucivorus. 38. G. T. thorace subquadrato lævi, alis viridibus fusco maculatis, antennis setaceis longitudine corporis. *Habitat in* Europa.
(C. Linnæus, 'Syst. Nat.' ed. x, tom. i, p. 431, 1758.)

870. GRYLLUS *verrucivorus* thorace subquadrato lævi, alis viridibus fusco maculatis, antennis setaceis longitudine corporis.
Gryllus cauda ensifera recta corpore subviridi. *It. goth.* 253. *Fn.* 621.
Habitat in pratis. Rustici huic insecto verrucas manus admovent, quas præmordet et evomit in vulnus liquorem, unde verruca contabescit.
Descr. Distinguitur a reliquis variis notis. *Thoracis* armatura triangulari, seu ad latera deorsum producta et a tergo versus alas dilatata. *Femina* ad anum ensem gerit bivalvem; *Mas* elytris versus basin foramine amplo, membrana pellucida consolidato, quibus sonum effecit sub cantu. *Color* totius corporis maxima ex parte viridis.
(C. Linnæus, 'Faun. Suec.' p. 237, 1761.)

Male Imago (Pl. XVII, fig. 1).—*Colour* a combination of green and yellowish or olivaceous brown. *Length* some 28–35 mm. *Head* with broad and rounded vertex; frons green or reddish yellow; antennæ about as long as the body. *Pronotum* very pronouncedly saddle-shaped, dorsal part flat, widening backwards, with a median and two lateral carinæ; side-flaps also flat, colour greenish or yellowish, or the two combined. *Elytra* longer than the body, green or green and brown, with very dark markings, especially a row, or rows, of large spots along the central region of the elytra, each spot consisting of a dense cluster of small ones. *Wings* fully developed, hyaline, slightly brown along the costal region. Fore *femora* very short, hind ones very long, greenish, very much swollen at the base and there having darker markings arranged somewhat as a series of transverse lines. Fore *tibiæ* with a row of four spines above; hind tibiæ with four strong apical spines below. The *plantules* of hind tarsi not very long. *Abdomen* brownish, on the sides the margins of segments paler and there with some dark dots. *Anal segment* deeply excavated, with pointed lobes. *Cerci* stout, a short tooth at about the middle. *Subgenital lamina* slightly emarginate, with rather long styles.

Female Imago (Pl. XIV, fig. 2).—*Colour* much as in the male. *Length* some 35 mm. *Elytra* and *wings* fully developed as in the male. *Cerci* without a tooth. *Sub-*

genital lamina triangular, roundly emarginate at the apex. *Ovipositor* some 21 mm. long, brown, smooth, nearly straight till towards the tip, where it turns upwards somewhat, is a little wider, and is slightly crenulated.

Egg.—Cigar-shaped, but slightly curved; brown; about 5 mm. long and 2 mm. in greatest width. (Extracted from the body of a female.)

Nymph.—All the examples of this insect that I possess are mature. Of the nymphs Brunner says: "Larvæ alis maculis magnis duabus nigris, interdum obliteratis." This says but little, as apparently the dark spots on the wing-pads are not peculiar to this species.

Variation.—*T. verrucivora* is subject to considerable variation in both size and colouring. In the usual form green is the prevailing colour; but this tint may be replaced to a great extent by brown. This form was described by Curtis from specimens in the cabinets of Dale and Haworth as *Acrida bingleii* in the following terms, Curtis considering it a distinct species:— "*Male* brown, tinged with green. Head rounded, pale and dull green. Thorax of the same colour, slightly carinated, dilated behind. Abdomen piceous, edges of the segments pale. Elytra pale fuscous, tinged with green, spotted with brown, the central spots the largest, interior margin green towards the base. Wings transparent greenish at their base. Legs griseous-yellow; posterior thighs green at their base, variegated with brown. *Female* dull and pale ochraceous, variegated with brown. Abdomen pale down the back; piceous on the sides with irregular pale margins to the segments. Ovipositor slightly recurved, brown with a rosy tinge." Azam, under the name *buyssoni*, describes a form with the hind margin of the pronotum more rounded, the spot on the side-flap more clearly defined, the elytra longer, the pointed lobes of the supra-anal plate straight, and

the subgenital plate more strongly emarginate. Some Lydden examples suggest this form.

Date.—July 3 is the earliest date given for the capture of this species in England—by J. C. Dale in the New Forest. We have also records for 20 July; 30 July; 14 August; 25 September at Lydden near Dover; and 16 October at the same place.

Habits, etc.—*T. verrucivora* should be looked for in dry barren spots, clearings in woods, and other similar places. Patience is required in stalking it down, since it chirps only when the sun is hot. Once detected, however, to follow it is easy, as its long legs and "oily" green colour are very conspicuous. It looks like a frog when making its great leaps in the long grass. The specific name *verrucivora*, or "Wart-biter," is due to a habit of the Swedish peasants, who used them, so Linnæus tells us, to bite off their warts. Possibly the brown fluid discharged from the mouth, when this and other grasshoppers are handled, may have some salutary effect conducing to the disappearance of the warts, presuming, of course, that they do disappear under this drastic treatment.

Distribution.—Generally speaking this grasshopper is found in Europe and in Northern and Western Asia. In Europe it occurs from Lapland to Greece —Sweden, common; England, very sparingly; France, common; Holland; Belgium, fairly common; Italy, in the Alps to 7000 feet; Spain, apparently only in the mountains; Montenegro; Wallachia.

Distribution in Britain.

It is unfortunate that the finest of our Locustids should also be the least common. So far as we know it has occurred only at a few spots in the south of England; but, as it is frequent in Sweden, there is no apparent reason why it should be so local, and why it should not occur in Scotland. Stephens says that it "once occurred in great plenty in a field near Rochester in September, where it was observed by Professor Henslow, to whom I am indebted for fine examples." J. C.

Dale told Curtis that the brown form, *bingleii* Curtis, "was first taken at Goodwin's Croft, near Christchurch, Hampshire, and given to the late Rev. W. Bingley. Dale's female was taken 30th July, 1818, by the side of a barley field near Christchurch, and his male at the same place the 14th of August following."* A male *bingleii* (probably one of Curtis' types) but of the *green form* (!) is in the Hope Museum at Oxford (*Burr*). C. W. Dale speaks of a fine female (colour not mentioned) taken by his father in the New Forest, 3 July 1844. Here I might mention that H. Bath speaks of a var *binglii* taken in the New Forest in September, 1891. Eland Shaw records two green females taken by H. C. Phillips at St. Margaret's Bay, Kent, in August 1886, and Bath a green female from Deal in 1889, in which year Burr says two green females were taken at St. Margaret's Bay. Since then Sandison has taken it in the latter locality, and the late Rev. E. N. Bloomfield informed me that Gordon Murray took a green female there in 1900. About 1907 Burr discovered a colony at Lydden about four miles from Dover, and gave me two males taken there. In 1913 Porritt found it rare in this locality.†

Genus 4. **PHASGONURA** Stephens.

Phasgonura Steph. Ill. Brit. Ent. Mand. vi, p. 15 . . .	1835.
Tettigonia, part, Linn. Syst. Nat. (ed. x), i, p. 429 . . .	1758.
Locusta Geoffr. Hist. Ins. i, p. 396	1762.
Acrida Kirby Zool. Journ. i, p. 432	1825.
Acrida Curtis Brit. Ent. ii, pl. lxxxii and text	1825.
Conocephalus, part, Thunb. Mém. Acad. Pétersb. v, p. 278 .	1815.

Stephens thus describes the genus: "Body elongate, stoutish, smooth; front acuminated between the antennæ, the latter longer than the body, with the basal joint very robust and produced within, the second also robust, but much smaller; the remainder extremely minute, and gradually diminishing in breadth to the apex; eyes large, prominent; thorax depressed above and flattened behind, where it bears an abbreviated ridge, the sides rather suddenly deflexed, the hinder margin rounded and produced; elytra considerably

* Curtis, 'British Entomology,' No. 82, where *A. bingleii* is beautifully figured.

† Some of the records of this species are a little confused; they perhaps require careful sifting, if this is now possible.

longer than the abdomen, very much deflexed, immaculate, flat at the base of the suture, where in the male is an ocellar process, transparent on the right elytron; wings ample, narrowish, as long as the elytra; breast beneath with two spinous processes and four elongate lobes; abdomen of the males with four styles at the apex, and of the female with two and an elongate straight acute ovipositor; legs moderate; hinder femora with a groove beneath; tibiæ spinous, posterior with two distinct rows of minute spines." ('Illus. Brit. Ent., Mand.' vol. vi, p. 15, 1835.)

1. **Phasgonura viridissima** Linn.

(Plate XIV, fig. 1; Pl. XVII, fig. 2; Pl. XVIII, figs. 1 and 2.)

viridissima	Linn. Syst. Nat. (ed. x), i, p. 430, n. 37 . . .	1758—*Gryllus Tettigonia.*
viridissimus	Linn. Faun. Suec. (ed. ii), p. 237, n. 869 . . .	1761—*Gryllus.*
viridis cantatrix	De Geer Mém. Ins. iii, p. 428, n. 1.	1773—*Locusta.*
viridissima	Fabr. Syst. Ent. p. 286, n. 22	1775—*Locusta.*
viridissimus	Thunb. Mém. Acad. Pétersb. v, p. 278	1815—*Conocephalus.*
viridissima	Westw. Stephens Ill. Brit. Ent. Mand. vi, p. 16 . .	1835—*Phasgonura.*
„	Brunner Prodr. Eur. Orth. p. 307	1882—*Locusta.*
„	Finot Faune de la Fr., Orth. p. 191	1889—*Locusta.*
„	Eland Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 62	1890—*Locusta.*
„	Burr Brit. Orth. p. 54, pl. iv, f. 11	1897—*Locusta.*
Viridissima	Kirby Syn. Cat. Orth. ii, p. 217.	1906—*Phasgonura.*
viridissima	Burr Syn. Orth. W. Eur. p. 93	1910—*Locusta.*
„	Lucas Proc. S. Lond. Ent. Soc. p. 53, pl. i, f. 1; pl. ii	1914—*Phasgonura.*

Original Description.

viridissimus. 37. G. T. thorace rotundato, alis viridibus immaculatis, antennis setaceis longissimis.
Habitat in Europa.
Ensis rectissimus, strictus.
(C. Linnæus, 'Syst. Nat.' ed. x, tom. i, p. 430, 1758.)

869. GRYLLUS *viridissimus* thorace rotundato, alis viridibus immaculatis, antennis setaceis longissimis.
Habitat in Pratis rarius.
DESCR. *Corpus* inter nostrates maximum. *Caput* et Thorax olivaces. *Thorax* lævis nec angulatus, dorso planiusculus lobo scutellari obtusissimo. *Alæ* virides immaculatæ. *Ensis* recta.
(C. Linnæus, 'Faun. Suec.' p. 237, 1761.)

MALE IMAGO (Pl. XVII, fig. 2).—*Colour* bright rich green, sometimes partly light brown above. *Length* some 30 mm. *Head* greenish, with the vertex bluntly protruding between the eyes, and there divided by a longitudinal furrow. *Pronotum* green or pale brown, saddle-shaped, smooth, rounded behind, often with a darker streak down the middle, sometimes with a slight dorsal carina behind, no lateral carinæ. *Prosternum* with two long spines, meso- and meta-sternal lobes pointed. *Elytra* fully developed, green, anal region modified and variegated with brown and yellow. *Wings* fully developed, hyaline, slightly green along the costal edge; nervures pale brown. *Legs* green; fore and mid femora with short black spines on the front margin below, hind femora with them on both margins; fore tibiæ with a tympanum on both sides and with three spines above; hind tibiæ with two apical spurs above and four below. *Anal segment* deeply sulcate, produced behind into two lobes. *Cerci* long, slender, green, with an internal basal tooth. *Subgenital lamina* with long yellowish styles.

FEMALE IMAGO (Pl. XVIII, fig. 1).—*Colouring* much as in the male. *Length* some 30–35 mm. Anal region of the elytra unmodified, and with a varying amount of brown colouring. *Elytra* and *wings* both fully developed as in the male. *Cerci* shorter, without a tooth. *Subgenital lamina* strongly emarginate. *Ovipositor* some 24 mm. long; nearly straight, but turned slightly downwards towards the tip; green, becoming brown at the apex.

EGG.—Closely resembling that of *T. verrucivora*; dark brown; cigar-shaped, but curved more on one

side than on the other; about 5·5 mm. long, by about 1·5 mm. broad.

Metamorphosis.—In 1913 A. B. Luvoni was fortunate enough to be able to observe the development of a female nymph. An interesting note by him on the subject appeared in the pages of the 'Entomologist,' the substance of which is here given. The nymph was captured on 22 June, and, judging by what followed, appeared to be in the second or third stage. The ovipositor was about 3 mm. long, and the wings were scarcely noticeable. Various kinds of grass, dandelion, knapweed, bindweed, and one or two kinds of buttercup were supplied as food. The next day it was found to have fed freely on *Ranunculus repens*, feeding-time being apparently night or early morning. This plant be it noted was growing in profusion where the nymph was captured. On 25 June an ecdysis took place, after which the ovipositor and wings measured 6 mm. and 3 mm. respectively. The next occurred on 10 July, when the ovipositor became 15 mm. and the wings 9 mm., while the total length was 34 mm. After the second ecdysis the antennæ, which had been damaged and were unequal in length, became normal. The final ecdysis took place on 31 July about 6.30 a.m., and the imago, after eating the empty skin, clung for some time to the grass-stems, apparently to allow of the proper development of the wings. For three days before an ecdysis the nymph ceased to feed and became sluggish and whitish in colour, and it was two days after the change before proper coloration was acquired. The cast skin was always eaten, the time occupied in the feast being about one and a half hours, and the hind legs being eaten last. This nymph particularly appreciated being placed in the sun.

Variation.—*P. viridissima* is not variable to any extent. There is, however, some difference in size, and in the amount of brown colour which usurps the green. On one occasion Porritt examined some thirty specimens and found that three or four of them (in-

cluding both sexes) had bright yellow legs, while all the rest had them olive-coloured.

Date.—Nymphs have been noted as occurring in June and as late as the end of July, while adults have been recorded in late July, August, September, and till October the 6th, the best months for the species being apparently August and September. R. M. Sotheby kept alive till a few days before 14 November one captured on 22 July.

Habits, etc.—Cliff-sides covered with rough vegetation, thick herbage on sandhills, sunny hedge-banks, beds of nettles, thistles, bramble-bushes, furze-bushes, thickets, trees occasionally, and raspberry-canes in a garden—such are some of the spots chosen by the "Great Green Grasshopper." In most of these places so well is it protected by coloration that until it moves or chirps it is not easily detected. Not perhaps so skilful at hopping as some of its kind, it moves rapidly nevertheless, running being apparently its chief mode of progression: it is also able to fly. A curious habit it has when crawling on a smooth surface. An immature Locustid, presumably *P. viridissima*, was sent to me on one occasion. It was put into an ordinary breeding-cage, up the glass face of which it began to crawl. While doing so it continually put its tarsi into its mouth, apparently to make them wet, so that they might cling the better to the smooth surface. W. G. Tenant* relates how one he kept in captivity did exactly the same thing.

Vegetable substances, maybe, are the normal food of *P. viridissima*, and it certainly devours grass. Morley found it upon and eating *Angelica sylvestris*, while it has been noticed eating seeds of a dock placed in its cage, and Luvoni fed a nymph he was rearing on *Ranunculus repens*. It, however, readily feeds on animal matter, such as small grasshoppers, whose neck one was noticed often to break before it ate them;

* 'Entomologist,' 1878, p. 183.

small house-flies too are readily taken. Tenant mentions that a captive in his possession ate a yellow underwing moth (*Tryphæna pronuba*), and extracted and ate the honey-bag of a humble-bee; it also killed and fed freely on butterflies supplied to it. Like other Locustids, this species readily turns cannibal, and feeds on dead examples of its own species, possibly having killed the victims first. The entomologist's "sugar" has frequently been found attractive—not only the sugar itself, but also the moths that come to feast upon the sweets. It will feed on sugar in captivity.

Many an account has been given of the harsh and strident "song" of the great green grasshopper and of the means by which the sound is produced. In an early volume of the 'Entomologist'* will be found the following interesting note on this subject by R. Laddimann:—

"I have for several years past been entertained by their nocturnal concerts in my 'mothing' expeditions. The males commence their stridulations just before sundown, which extend far into the night, and the performance of several of these insects in close proximity is almost deafening. . . . The male takes up his position on the topmost twig in the hedgerow—often on an ear of corn—which position he will maintain during the whole of the evening, and will there 'rasp' away unceasingly for hours, if not disturbed; he will often be found performing on or near the same twig the next evening. Three years ago I turned out a male of this insect in my garden, who perched himself on the topmost branch of a tall larch tree, where he carried on his harsh evensong for more than a week, when I missed him and never heard him afterwards. These insects seem to be gifted with a species of ventriloquism, for it is often extremely difficult to mark the spot whence the 'singing' appears to proceed. . . . In confinement these grass-

* 1879, p. 21.

hoppers will sing as vigorously as if in their native haunts."

After death, while the muscles are still relaxed, the chirping may be produced mechanically by moving the wings as the insect does.

Porritt states* that in the second half of August 1888, near Deal in Kent, it occurred in plenty. It was found most readily after dark by the aid of a lamp, and a dozen adult specimens might easily have been found in an evening on the tops of the rank herbage skirting the sandhill ditch. This grasshopper bites readily and fiercely, so it is best to hold it by both its long hind-legs. If one only is held, the insect will break itself free, leaving the leg behind. In 1905, on the North Cornish coast A. E. Gibbs found it come to "sugar" as a nymph at first, as well as in the adult stage later.

Distribution.—Europe, North Africa, Asia Minor, and Amur—common in Europe, from Sweden to Sicily; abundant in France and Belgium; common in the south of England, locally, chiefly near the southern coast; Holland; etc.

British Localities.

If we were to judge by records only, we should conclude that *P. viridissima* is practically unknown as a British insect outside England. In G. Don's 'Account of the Plants and Animals of the County of Forfar,' 1813, *viridissimus* is mentioned certainly, but if it was present in Scotland then it has since disappeared—or perhaps, needs to be rediscovered. For Ireland I have not seen a suggestion of its presence! R. J. Pocock took it in Glamorganshire, thus providing a solitary record for Wales.

England.—*Berks:* Tubney (*Hamm*), Chilswell Hill near Oxford (*Lucas;* possibly Wood's "outside Oxford" refers to the same locality); Streatley (*Tomlin*). *Cornwall:* Abundant near Mawgan Porth and not common at Widermouth Bay near Bude (*Bracken*); Tresco in the Scilly Isles (*Norgate*); Pendower Castle on the east coast (*Hodge*); very common near Padstow (*Lamb*); Land's End (*Shaw*). *Cumberland:*

* 'Ent. Mo. Mag.' 1889, p. 215.

A record for Cumberland is found in Stephens' 'Illustrations.' It would probably be on the authority of T. C. Heysham (*F. H. Day, in litt.* to *Burr*). *Derbyshire:* One brought to the Museum at Derby by a boy, taken a few miles from Derby about 1896 or 1897 (*Pullen*). *Devon:* Bickleigh, Horrabridge, Bovisand, and near Plymouth (*Bignell*); Teignmouth, Newton Abbott, and Saunton (*Parfitt*); Churston (*Porritt*); Torquay (*Hamm*); Ilfracombe (*Sopp*); Dawlish (*Champion*); Beer (*Lyle*); Dartmouth and Axmouth (*Edwards*); Cawsand a village on Plymouth Sound, Ivybridge, Laddiswell, Woolacombe, and Bovey Tracey (*Bracken*). *Dorset:* Cliffs near Swanage (*Lucas*); Wyke Regis near Weymouth, and Osmington Mills (*Lyle*); Bridport (*Shaw*). *Essex:* Colchester (*Harwood*); Felixstowe (*Dodds*); Southend (*Powers*); Westcliff (*Luvoni*); *Hants:* Avon side at Christchurch (*Lyle*); Lymington (*Meek*); Pokesdown (*Robertson*). *Isle of Wight:* Freshwater (*Sopp*); Cliffs at Compton Bay, and inland (*Burr*); stridulation heard in Parkhurst Forest (*Burr*); Blackgang, and the Undercliff (*Burr*); White Cliff Bay (*R. W. Poulton*); Ventnor (*Turner*). *Hertfordshire:* Hertford (*Stephens*). *Huntingdonshire:* Ramsey (*Oliver*). *Kent:* Abbot's Wood (*Sotheby*); Folkestone (*Briggs*); St. Margaret's Bay (*Porritt*); Deal (*Clarke*); Broadstairs (*Fowler*); Doddington (*Chitty*); Ramsgate (*Eland Shaw*); Sandwich Bay, Herne Bay, Eastry, Fredville, and Adisham (*Burr*); Seabrook between Hythe and Sandgate (*Richards*). *London:* Willesden (*Klein*); Battersea Fields (*Stephens*). *Norfolk:* (*Edwards*); Huckling Marshes (*Balfour-Browne*); King's Lynn (*Atmore*); Caistor Marrams (*Paget, fide Bloomfield*). *Northants:* Peterborough, and near Walton Station (*Morley*). *Oxon:* Islip (*Bayzand*); near Binsey (*Holland*); Hardwicke near Reading (*Holland*); "The Parks" Oxford (one male in Hope Collection). *Rutlandshire:* according to the Victoria History of the county. *Somerset:* Cheddar (*Edwards*); Burnham (*Blathwayt*); Weston-super-Mare (*Whittaker*). *Suffolk:* Near Felixstowe (*Gurney*); Claydon (*Morley*); banks of the Gipping at Sproughton (reported to *Morley*); one or two in coll. Wheel (*fide Morley*); Bury St. Edmunds (*Tuck*). *Surrey:* Near Godalming (*Latter*); near Thursley (*Dalgliesh*); Pickett's Hole, Ranmore (*Williams*). *Sussex:* Near Chichester (*Roebuck*); Hastings Cemetery (*Bloomfield*); Bognor (*Guermonprez*); Eastbourne (*Main*). *Yorkshire:* (*Porritt*).

Wales.—*Glamorgan:* Rhosili (*Pocock*).

Genus 5. **CONOCEPHALUS** Thunberg.

Conocephalus Thunberg Mém. Acad. Pétersb. v, p. 218 . . 1815.
Anisoptera Latr. Cuv. Règne Anim. (ed. ii), v, p. 184, note . 1829.
Xiphidion Serv. Ann. Sci. Nat. xxii, p. 159 . . . . . 1831.
Xiphidium Burm. Handb. Ent. ii, p. 707 . . . . . 1838.

Thunberg thus diagnoses the genus:—

Antennæ setaceæ, corporis longitudine.

Caput convexum, acuminato-conicum.

Thoraæ convexus, supra planiusculus, deflexus, postice rotundatus.

Corpus elongatum, angustatum.

Hemelytra alis æqualia, lanceolata, obtusa, deflexa, apice compressa, corpore duplo longiora.

Pedes ut in Gryllis.

1. **Conocephalus dorsalis** Latr.

(Plate XIV, fig. 6; Pl. XV, figs. 3 and 4.)

dorsalis Latr. Hist. Nat. Crust. Ins. xii, p. 133, n. 9 . . . . . 1804—*Locusta.*
dorsale Burm. Handb. Ent. ii, p. 708, n. 5 . 1838—*Xiphidium.*
„ Brunner Prod. der Eur. Orth. p. 302 1882—*Xiphidium.*
„ Finot Orth. France, pp. 101, 102 . 1883—*Xiphidion.*
„ Finot Faune de la Fr. Orth. pp. 187, 189 . . . . . 1889—*Xiphidion.*
„ Shaw Mon. Brit. Orth., in Ent. Mo. Mag. p. 61 . . . . . 1890—*Xiphidium.*
„ Burr Brit. Orth. p. 53, pl. iv, f. 10 . 1897—*Xiphidium.*
„ Lucas Entomologist, p. 290, pl. iii, f. 2 1899—*Xiphidium.*
Dorsale Kirby Syn. Cat. Orth. ii, p. 282 . . 1906—*Anisoptera.*
dorsale Burr Syn. Orth. W. Eur. p. 91 . . 1910—*Xiphidium.*
dorsalis Lucas Proc. S. Lond. Ent. Soc. p. 53, pl i, f. 6 . . . . . 1914—*Conocephalus.*

(Other synonyms: *L. fusca* Zett.; *C. discolor*, ♀, Thunb.)

Original Description.

9. S. dorsale; *l. dorsalis.*

Verte; antennes, dos du corselet et élytres, bruns; elevation sur le vertex de la tête; élytres un peu plus longues que la moitié de l'abdomen, dépassant un peu les ailes, arrondies au bout. Tarière de la femelle presque de la longueur du corps, arquée, brune; abdomen brun, cerclé de verd.—Sur les bords de l'étang de Saint-Gratien, aux environs de Montmorency. [This was placed in a group headed *** Elytres

sensiblement plus courtes que l'abdomen, ou très courtes, quelquefois nulles.]

(P. A. Latreille, 'Hist. Nat. Crust. et. Ins.' xii, p. 133, 1804.)

Male Imago (Pl. XV, fig. 3).—In general bright green in *colour*, except along the middle of the dorsal aspect of the body from tip of head to end of abdomen, this being dull crimson. *Length* some 13 mm. *Head* greenish, dull crimson dorsally, with the vertex produced considerably between the antennæ as a flattened vertical plate. *Antennæ* very long and slender. *Pronotum* rounded, without carinæ; an inflated spot, resembling a small bubble at the hind margin of each flap; a broad, mid-dorsal, dull crimson stripe. *Prosternum* with two spines. *Elytra* nearly hyaline particularly in the costal region, in the middle region pale reddish brown with brown nervures; acute; produced at the anal angle; shorter than the abdomen. *Wings* considerably shorter than the elytra, with brownish nervures. *Fore coxæ* with a long curved spine. *Fore tibiæ* without spines; tympana almost hidden. *Hind tibiæ* long, slender, with two apical spurs above and four below. *Hind femora* swollen towards the base, then very slender; without spines below. *Anal segment* with two prominent blunt teeth, hiding the supra-anal plate. *Cerci* stout, pointed, rough, with a curved tooth near the tip. *Styles* short, straight.

Female Imago (Pl. XV, fig. 4).—*Colouring* similar to that of male. *Length* some 14–16 mm. *Elytra* reduced as in male. *Wings* reduced far more than elytra. *Cerci* not toothed. *Ovipositor*, nearly 8 mm. long; pale brown; gradually turned upwards; slightly crenulated at the tip.

Egg.—One egg which I possess (extracted from the body of a female) is pale in colour and therefore probably not ready to be deposited. It is cylindrical with rounded ends, and somewhat more curved and slender than those of Locustids already noticed. Still it quite preserves the "family-likeness."

Nymph.—Nymphs of the grasshoppers usually collapse very badly in drying, but this species is one of the worst offenders. However, the resemblance to the adult is always sufficient to prevent misidentification. Bracken, who tried to rear a Devonshire nymph, says of it that it had the characteristically produced vertex but the elytra and wings were not yet developed. The oily-green colour of the adult stage was evident, and the dorsal reddish-brown stripe was very marked. Its length was 5 mm., and it was taken on 10 June.

Variation, etc.—One hot day in August 1899 W. H. Harwood captured a macropterous form of *C. dorsalis* on the Essex coast, not far from Clacton-on-Sea. It presented a very strange appearance on the wing. He and his son disturbed and caught another, which was set free as its antennæ were defective. They could meet with no more. Though Harwood had frequently seen the species in the locality, he had not previously found a macropterous specimen. Examination of normal specimens at once reveals the fact that though elytra are useful for stridulation, both they and the wings are quite useless for flight. In this example, however, the wings and elytra are from 18 to 19 mm. long—fully developed in fact—and quite suitable for use in flight. The macropterous condition in *C. dorsalis* is certainly rare, even if it has previously been noticed at all. This condition of the species recalls to some extent a neighbouring species, *C. fuscus* Fabr.

Date.—Late summer is the time for this insect, August and September being the best months. It is doubtful if mature examples have been met with in July, but they may extend into October. Nymphs have been observed as early as 10 June and as late as 2 October.

Habits, etc.—Herbage; reeds; associated with *Carex*, *Angelica*, and sea-lavender; marshy ground; salt-marshes, sandhills—such are some of the haunts that

C. dorsalis selects. In consequence of possessing such tiny wings it cannot fly, but it hops very actively from blade to blade of the tussocks of long grass amongst which it lives, and, as it clings very tightly to them, it is not easy to secure the insect by sweeping, nor would it be wise to try, the build of the creature being so frail. Perhaps the hands are the best implements with which to effect its capture, as they are certainly the readiest. If thoroughly disturbed it goes down towards the roots of the grass, and there cannot be found. It seems to like tussocks of a tall, soft, pale green grass, and apparently prefers wet spots, though its habitat may not be entirely restricted to them.

On one occasion a nymph was observed to be extremely well protected on a blade of grass, where it rested with its legs stretched out in a line with its body in some such manner as many of the long-legged spiders do. Such a position it took up very readily. Its habitat, usually not very accessible, also serves it as a means of protection. On one occasion Edelsten found them " very common on reeds at night in the Norfolk Broads "—on 28 and 29 July 1906. The colour of the liquid emitted from the mouth when the insect is held captive is in this case dark purple-brown. What appeared to be a case of cannibalism has come under my notice.

Porritt, who found several near Churston in South Devon in the years 1900 and 1902, gave Bracken in 1912 the precise spot where he might be expected to find them. A search on 26 August 1914, made by the latter, was rewarded by the capture of three specimens, after five hours of patient sweeping. These three (two males and a female) were taken in exactly the same spot as that in which Porritt took them some ten years before. This is a striking illustration of the way in which certain insects continue to breed for years in a limited area. This grasshopper presents a graceful and pretty appearance when, in its favourite haunts, it suns itself on rushes or leaves of iris, its long antennæ

gently waving like threads of spun glass. Porritt's colony still persisted in 1916. On 23 August in that year Bracken and his son, in the intervals between showers of heavy rain, swept yards and yards of rushes standing in several inches of water, and took six, missing others. Sweeping damages them, but it was the only method of capture available on this occasion.

DISTRIBUTION.—Widely distributed, though local, in northern and central Europe—in Sweden and Denmark; Holland and Belgium; England, locally; France, chiefly in the north; Germany, commoner in the north than in the south; Austria, rather rare.

BRITISH LOCALITIES.

No doubt this is a scarce insect in Britain; but searching for it in the kind of habitat in which it delights is not always easy or pleasant, so that it may not be quite so uncommon as at first sight appears. All the known localities for it are in the south and east of England, usually near the coast.

Records are:

ENGLAND.—*Cambridgeshire:* Chippenham Fen (*Porritt*); Cambridge (*Babbington*, in Stephens' 'Illustrations'); Wicken Fen (*Lyle*). *Devon:* South, not uncommon (*Porritt*); Broadlands, Churston (*Porritt*); Churston Ferrers (*Edwards*); Budleigh Salterton (*Champion*); Bere Alston, River Tavy (*Bracken*). *Dorset:* Near Studland (*Lucas*). *Essex:* Near Clacton, macropterous (*Harwood*); Walton-on-the-Naze (*Yerbury*); North Essex coast (*Harwood*). *Hants:* Denny Bog, New Forest (*Lucas*); near Hengistbury Head (*Lucas*). *I. of Wight:* Between Freshwater and Yarmouth (*C. W. Dale*); Yarmouth (*Burr*); near Freshwater (*Burr*); Rookley Wilderness (*Morley*). *Kent:* Herne Bay (*Saunders*); Deal (*Porritt*); Blean Wood, Sheppey (*Chitty*); Sandwich, and at Ham Ponds near Eastry (*Burr*). *Norfolk:* Horning and Ranworth (*Edwards*); Wood Marsh, Sutton (*Balfour-Browne*); Broads [apparently Stalham] (*Porritt*). *Suffolk:* Barnby Broad, Benacre Broad, and Tuddenham Fen (*Morley*); Southwold (*Bloomfield*); Aldeburgh (*Scott*); Mildenhall (*Perkins*, in Camb. Univ. Museum). *Surrey:* Near Witley (*Dalgliesh*). *Sussex:* Guestling (*Bloomfield*); Pagham Marsh (*Guermonprez*).

Genus 6. **MECONEMA** Serville.

Meconema Serv. Ann. Sci. Nat. xxii, p. 157 . . . . . 1831.

Small, pale-green insects. Vertex bluntly produced between the antennæ, which are very long and have about seven distant dark rings. Pronotum small and smooth. Elytra, free from pronotum (in the English species), fully developed. Tympana of fore tibiæ open; male without stridulating apparatus. Fore tibiæ without apical spines. First and second tarsal segments sulcate at the side. Cerci of male long, entire, incurved with blunt apex. Styles small and hairy. Ovipositor long, gently curved upwards, margins smooth.

1. **Meconema thalassinum** De Geer.

(Plate XIV, fig. 3; Pl. XVII, fig. 5; Pl. XVIII, fig. 3.)

thalassina	De Geer Mém. Ins. iii, p. 433, n. 3	1771—*Locusta*.
varia	Fabr. Syst. Ent. p. 287, n. 24 . .	1775—*Locusta*.
,,	Serv. Ann. Sci. Nat. xxii, p. 158, n. 1	1831—*Meconema*.
varium	Fisch. Orth. Eur. p. 240, n. 1, pl. xii, ff. 19, 20	1853—*Meconema*.
,,	Brunner Prod. der Eur. Orth. p. 296	1882—*Meconema*.
varia	Finot Faune de la Fr. Orth. p. 185 .	1889—*Meconema*.
varium	Eland Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 60 . . .	1890—*Meconema*.
,,	Burr Brit. Orth. p. 52, pl. iv, f. 9 .	1897—*Meconema*.
Thalassina	Kirby Syn. Cat. Orth. ii. p. 370 .	1906—*Meconema*.
varium	Burr Syn. Orth. W. Eur. p. 89 .	1910—*Meconema*.
thalassinum	Lucas Proc. S. Lond. Ent. Soc. p. 52, pl. i, f. 3	1914—*Meconema*.

(Other synonyms: *G. arboreus* Fuessly; *G. viridissimus minor* Sulz.; *G. falcatus* Schrank; *G. nana* Stoll.)

Original Description.

3. *Sauterelle d'un verd céladon, à antennes et pattes jaunâtres, à tarriere recourbée dans la femelle.* Sauterelle céladon.

Locusta (thalassina) *caeruleo-viridis, antennis pedibusque flavescentibus, cauda foeminae ensifera recurvata.* . . .

Cette Sauterelle ressemble beaucoup, à la grandeur près, à la grand Sauterelle toute verte qui chante sur les arbres; mais elle est petite et au dessous de la grandeur médiocre, ou longue de huit lignes. Je l'ai

trouvée à Utrecht sur l'Orme, mais je ne'ai pas encore vûe en Suede. Elle est entierement d'un verd céladon sans taches. Les antennes, qui sont jaunâtres de même que les pattes, sont longues, déliées et à filets coniques. On ne lui voit point d'yeux lisses. La femelle porte une tarriere recourbée en dessus en forme de faucille et de la longueur du corps.

(C. de Geer, 'Mém. Ins.' iii, p. 433, 1773.)

Male Imago.—General *colour* pale green, yellow dorsally; *length* some 12–14 mm. *Head* with the vertex produced to a point between the swollen bases of the *antennæ*, which are very long, and distantly marked with several minute dark brown rings. *Eyes* projecting. *Pronotum* short, much rounded behind, practically without carinæ, yellow mid-dorsally, with two small black spots. *Elytra* fully developed, bright

Fig. 21.—Apex of abdomen and cerci of male *Meconema thalassinum* De Geer (much magnified).

green with paler nervures, semi-transparent. *Wings* fully developed, hyaline, tinged with green towards the costal margin. *Legs* pale, hind femora not greatly swollen at the base; tympana on fore tibiæ open; tarsi brown. *Cerci* (fig. 21) long, slightly hairy, slender, blunt and slightly clubbed at the tip, crossing, not toothed. *Subgenital lamina* broadly emarginate; short hairy *styles* bent backwards.

Female Imago (Pl. XVII, fig. 5).—In *colour* much as the male; perhaps slightly less in *length*. *Elytra* and *wings* fully developed as in the male. *Cerci* short, simple. *Ovipositor* 9 mm. in length; green with brown tip; gently curved upwards. *Subgenital lamina* with two sharp projections in the centre, nearly in contact.

Egg-laying (Pl. XVIII, fig. 3).—On 19 October

1911 G. T. Lyle, while "sugaring" in the New Forest at 6.45 p.m. noticed a *Meconema thalassinum* ovipositing in the chinks of the bark of an oak-tree. The ovipositor was inserted to half its length. A second insect was also noticed in a similar position on a neighbouring tree. On visiting Holland's Wood a night or two afterwards the grasshoppers could be found ovipositing on every fifth or sixth tree. This plenty continued till 27 October, but when another visit was paid to the spot on 14 November not a single grasshopper could be detected. *M. thalassinum* is frequently seen on the tree-trunks in the autumn, which is clearly the normal period for egg-laying. The eggs themselves I do not know.

Nymph.—Larger nymphs resemble very closely the adults, but the absence or rudimentary condition of elytra and wings distinguishes them, and they could scarcely be confused with any other species.

Variation.—Notwithstanding the synonym, *varium*, by which this grasshopper was for a long time known, it is not at all a variable species, either in size or colouring: the original name, *thalassinum*, much better describes the insect.

Date.—This is an autumn insect in the adult form, for it seems seldom, if ever, to be mature before August. C. W. Dale records it "late in November" at Glanvilles Wootton. Burr says it sometimes may be taken crawling up the windows inside houses, even as late as November.

Habits.—*M. thalassinum*, the "silent grasshopper of the forest trees," is probably far more common than is generally supposed. It lives chiefly on oaks and limes, but does not confine itself to these trees; it has been found on maple, beech, and bay, and no doubt chestnut and other trees are favoured also. It has been bred from oak-galls—those of *Cynips kollari* Htg. We may assume, I suppose, that the female when ovipositing was tempted to make use of the hole by

which the hymenopteron escaped. Since this insect passes its life amongst the foliage of large trees, we may take it for granted that their leaves constitute its food. Whether this is so or not, its tastes are not entirely vegetarian, for it is found as a frequent visitor to the entomologist's "sugar." It is carnivorous also on occasion, for, of a pair put into a box without food, the female ate a great part of the male, though whether her companion died first I cannot say. "Beating" the trees is the best method of procuring specimens.

DISTRIBUTION.—In Europe this grasshopper is found from Southern Sweden to beyond the Alps—Sweden, Holland, Belgium, England, France, Denmark, Switzerland, Italy, Spain, Tyrol. It apparently does not extend to the East.

BRITISH LOCALITIES.

ENGLAND.—*Bedfordshire:* Near Bedford (*Porritt*). *Berks:* Streatley (*Tomlin*); neighbourhood of Radley College (*Burr*). *Bucks:* Chesham (*Donisthorpe*). *Cambridgeshire:* Whittlesford (*Lamb*); Cambridge (*Bateson*); Chippenhan Fen (*Edwards*); Wicken Fen (*Morley*); West Wickham (*Shaw*). *Cornwall:* It can be taken in abundance in August, September, and October in the Priory Gardens, Saltash (on the Cornish side of River Tamar, opposite Devonport), where it is found freely on bay (*Bracken*). *Devon:* Fairly common in woods and generally distributed (*Bignell*); Cann Woods and Shaugh Woods (*Bracken*); Lynmouth and East Lynn River (*Briggs*); Totnes (*Lucas*); Stoke Woods near Exeter (*Rowden*); near Bideford (*Ansorge*); Torquay and Bampford Speke (*Bracken*); Nymet Rowland and Churston (*Porritt*). *Dorset:* Glanvilles Wootton (*C. W. Dale*). *Essex:* Epping Forest (*Shaw*); Epping Forest near Chingford (*Campion*); Theydon Bois (*Milton*); Colchester (*Harwood*). *Hants:* New Forest, common (*Lucas*). *I. of Wight:* Found commonly by beating at Bordwood near Sandown, and on street lamps in Shanklin (*Poole*); in a house at Newport, and in Marvel Copse (*Morey*). In October and late into November they often come into houses through the windows: they seem commonest after high wind, which blows them down from the trees—chiefly

limes and oaks (*Morey*). *Herts:* Rickmansworth (*Carrington*); Shenley (*Speyer*). *Kent:* New Eltham (*Kemp*); Faversham District (*Chitty*); Dartford (*Shaw*); Maidstone (*Fremlin*). *London:* Hyde Park (*Winston*); Kensington Gardens (*Shaw*). *Middlesex:* Hanwell (*Webb*); Hayes Common (*Gibbs*); Bushey Park and Home Park Hampton Court (*Lucas*); Harrow Weald (*Priske*). *Norfolk:* (*Edwards*); Foxley Wood (Hope Coll. in Oxford). *Northants:* Easton Maudit (*Shaw*). *Notts:* Treswell Wood (*Shaw*); Aspley Woods (*Thornley*). *Oxon:* Oxford (in Prof. Westwood's Garden); Stonesfield, Witney, Milton-under-Wychwood, and Woodstock (*Holland*). *Somerset:* Combre Florey near Taunton (*Jones*); Batheaston (*Blathwayt*). *Suffolk:* Ipswich (*Morley*); Bentley Woods (*Morley*); Tostock (*Tuck*). *Surrey:* Leatherhead and Horsley (*Briggs*); Coombe Wood and Ripley (*Stephens*); Boxhill (*McLachlan*); near Ashtead, Kingston-on-Thames, Richmond Park, near Effingham Station, Oxshott, and Kew Gardens (*Lucas*); Royal Hort. Soc. Gardens, Wisley (*Wallis*); Surbiton (*Goss*); Dormans (*Burr*); Bisley (*Ficklin*); Witley (*Dalgliesh*). *Sussex:* Slindon, Dale Park, Bognor and district, and near Bosham (*Guermonprez*); East Grinstead (*Burr*); Guestling (*Bloomfield*). *Yorkshire:* Edlington Wood near Doncaster (*Porritt*).

Scotland.—In 'A List of Insects found in the neighbourhood of Edinburgh' by C. Stewart, 1809, *Gryllus varius* occurs. Also in G. Don's 'Account of the Plants and Animals of the County of Forfar,' 1813, the name *varius* is mentioned. If this insect was found in Scotland then it seems since to have disappeared; or, more probably, is awaiting a new discoverer.

Ireland.—Limerick (*fide Kemp*).

Genus 7. **LEPTOPHYES** Fieber.

Leptophyes Fieb. Lotos, iii. p. 174 . . . . . 1853.
Ephippigera (preoccupied) Steph. Ill. Brit. Ent. Mand. vi, p. 11 1835.

Species small and fragile. Pronotum smooth. Elytra rudimentary; wings abortive. Fore coxæ unarmed. First and second segments of tarsi smooth at the side, without a groove. Ovipositor short, but broad and compressed, pointed, regularly rounded at the lower border; in the apical part fine serrations on both edges.

1. **Leptophyes punctatissima** Bosc.

(Plate XIV, fig. 5; Pl. XVII, figs. 3 and 4.)

punctatissima	Bosc Actes, Soc. d'Hist. Nat. Paris, i, p. 44, pl. x, ff. 5, 6 .	1792—*Locusta*.
,,	Serv. Ins. Orth. p. 480 . .	1839—*Barbitistes*.
,,	Fisch. Orth. Eur. p. 232, n. 10, pl. xii, f. 15	1853—*Odontura*.
,,	Brunn. Mon. Phan. pp. 78. 80 .	1878—*Leptophyes*.
,,	Prod. der Eur. Orth. pp. 284, 285	1882—*Leptophyes*.
,,	Finot Faune de la Fr. Orth. p. 180, pl. ix, f. 123 . . .	1889—*Leptophyes*.
,,	Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 58	1890—*Leptophyes*.
,,	Burr Brit. Orth. p. 50, pl. iv, f. 8	1897—*Leptophyes*.
Punctatissima	Kirby Syn. Cat. Orth. ii, p. 389	1906—*Leptophyes*.
punctatissima	Burr Syn. Orth. W. Eur. p. 86 .	1910—*Leptophyes*.
,,	Lucas Proc. S. Lond. Ent. Soc. p. 51, pl. i, f. 5	1914—*Leptophyes*.

(Other synonyms: *L. autumnalis* Hagenb.; *E. virescens* Steph.; *B. glabricauda* Borck (nymph); *Acrida Standishi* Dale (var.))

Original Description.

Locusta punctatissima.

Locusta. Aptera, viridis, thorace vittis duabus luteis, abdomine punctis numerosis fuscis, dorso linea ferruginea.

Habitat Parisiis.

[A long description in French follows. Pl. x, fig. 5 shows the male in dorsal view and the female in profile view.]

(L. A. G. Bosc, 'Actes Soc. d'Hist. Nat. Paris.' i, p. 45. 1792.)

Male Imago (Pl. XVII, fig. 3).—General *colour* full green with numerous small dark dots. *Length* 12 mm. *Under-surface* paler and unspotted. *Face* paler green, unspotted, upper lip whitish; *antennæ* very long, with a few dark rings, brownish with basal segments more yellow; *eyes* yellowish, marked with brown; top of head edged with yellow laterally. *Pronotum* green spotted and marked with reddish-brown, and bordered by a yellowish lateral line. *Elytra* reduced to about the length of the pronotum, dull yellow edged laterally with dark brown. *Wings* abortive. *Tibiæ* and *tarsi* brownish-yellow, *femora* green with black dots. *Abdomen* with rather broad mid-dorsal, ruddy-brown or yellowish line. The strongly incurved pointed *cerci*

pale ruddy yellowish-brown. *Subgenital lamina* yellowish, long, turned sharply upwards, truncate at apex, median longitudinal ridge below.

Female Imago (Pl. XVII, fig. 4).—*Colouring* much as in the male, but build somewhat more bulky. *Wings* abortive as in the male, and *elytra* still smaller than in that sex. *Ovipositor* short, broad, dilated at the base, then much compressed, upper margin slightly and lower very much curved upwards, shining green with crimson-brown margins, edges crenulated in the apical part.

Eggs (fig. 20).—In this species the eggs are totally unlike the eggs of any other British locustid with which I am acquainted. They are flat and very thin, elliptical in outline, reddish-brown in colour, and about 3 mm. long by 1·75 broad. To all appearance they are admirably adapted for laying in very narrow chinks in the bark of a tree.

Nymph.—Between the nymphs and the adults there is a very close resemblance which is enhanced by the very rudimentary condition, in the latter, of the organs of flight.

Variation.—There may be a little difference in size and slight differences in colour, but, as far as my own experience goes, the species is a very constant one.

Date.—Though imagines may sometimes occur at the end of July, August and September are the best months for adults. They may continue into October, and according to C. W. Dale they have occurred at Glanvilles Wootton late in November. No doubt the eggs are laid in the autumn and hatch in the following spring.

Habits, etc.—A strange looking insect is our sole representative of the genus *Leptophyes* and of the family Phaneropteridæ. It may be found on shrubs and bushes, a favourite resting-place apparently being the upper surface of a bramble-leaf, where, as it is far from agile, it may be captured without much trouble,

provided it is not startled so much as to cause it to drop amongst the lower herbage—its best method of escape. Other plants on which it has been recorded as seen are: a strawberry-bed in a garden, on and about young withey plants in an osier-bed, on alder leaves about two or three feet from the ground, and on clematis in a garden. Theobald speaks of it as a pest on peach-trees. Some examples captured in the New Forest in August 1914 fed well on mountain-ash leaves and on rose-leaves from the garden. One morning, out of three put alive in a glass-topped box one had disappeared with the exception of one or two small fragments. So evidently this species sometimes develops cannibalistic tastes. Early in September another, a female, seemed unwell, but nevertheless fed rather freely on rose-leaf; the next day it was dead. The remaining specimen, a male, was then "killed" in the cyanide-bottle and sent to G. T. Lyle together with a Hymenopteron, which appeared to have been bred from it. Lyle wrote saying: "On its arrival here I noticed that its antennæ were moving, and to-day, on opening the box, I was surprised to see it jump out: this evening it seems quite well." The Hymenopteron was a Braconid, and no doubt was bred from an *Aphis* accidentally introduced with the rose-leaves.

L. punctatissima has several times been noted as visiting the lepidopterist's sugar, where its plump little body, practical absence of organs of flight, and long legs, remind one somewhat of a spider rather than a grasshopper. Bignell bred the species from oak-galls (*Cynips kollari*) in May. In August 1908 some wood-ants (*Formica rufa*) were seen trying to carry away a specimen of this grasshopper, but I did not await the result of their endeavours.

To obtain specimens the lower branches of trees may be beaten as the lepidopterist beats for larvæ, or the low-growing bushes and herbage may be swept with a net, such as the coleopterist uses, strong enough to withstand the bramble-hooks; but, if its colours

will allow of its being detected, hand-picking is the best method to pursue for obtaining so delicate an insect. As the set specimen dries the fine green colour changes to a dull brown, but if the body is eviscerated, the contents being replaced by a small amount of cotton-wool, colouring alters but little, and the preserved insect gives a good idea of its appearance in the living state.

Distribution.—Central and south-eastern Europe—Sweden, Denmark, Holland, Belgium, Britain, France, Switzerland, Northern Italy, Austria, and Germany—also in Palestine.

British Localities.

Most of the records of *L. punctatissima* in these islands are from England and those chiefly from the south and east. There are besides single ones from Wales and Scotland, and two from Ireland.

England.—*Berks:* Bagley Wood, and the neighbourhood of Radley College (*Burr*). *Cambridgeshire:* Wicken (*Porritt*); Cambridge (*Bateson*). *Cornwall:* Widemouth Bay near Bude, and Saltash (*Bracken*). *Devon:* East Lynn and Lynmouth (*Briggs*); Cann and Bickleigh Woods (*Bignell*); Barnstaple, Nymet Rowland, and Churston (*Porritt*); Coombe Martin (*Shaw*); Totnes (*Swinton*); Plympton near Plymouth, Woolacombe, Shaugh Bridge, and Torquay (*Bracken*). *Dorset:* Glanvilles Wootton (*C. W. Dale*); Dorchester (*Sopp*); *Essex:* Colchester (*Harwood*). *Gloucestershire:* (*Edwards*). *Hants:* New Forest (*Lucas*); Hayling Island (*Guermonprez*); Lord Wood Southampton, and Aldershot (*Sopp*). *Herefordshire:* Lord's Wood (*Tomlin*). *Hertfordshire:* near Hertford (*Stephens*); Hemel Hempstead (*Gibbs*). *I. of Wight:* Yarmouth (*Morley*); Freshwater, Freshwater Bay, Compton, Blackgang Chine, Undercliff, and Parkhurst Forest (*Burr*). *Kent:* Folkestone Warren (*Moore*); Chittenden Woods near Strood (*Milton*); New Eltham (*Kemp*); Darenth and Birch Woods (*Stephens*); Huntingfield, Walmer, and Deal (*Chitty*); Dartford (*McLachlan*); near Maidstone (*Fremlin*); Blear Wood near Herne Bay (*Guermonprez*); Eastry, Sibertswold, and the Warren (*Burr*). *Lincolnshire:* Near Lincoln (*Musham*); Skellingthorpe Wood near Lincoln, and Gate Burton (*Shaw*); Little Bytham (*Stow*). *Middlesex:* Hanwell (*Webb*);

Twickenham (*McLachlan*); East Finchley (*Williams*). *Norfolk:* (*Edwards*); Bostal Heath near Plumstead (*Shaw*). *Somerset:* Batheaston (*Blathwayt*). *Suffolk:* Bury St. Edmunds (*Nurse*); Felixstowe, Bramford Marshes, Assington Thicks, Farnham, Derrington, and Bentley Woods (*Morley*). *Sussex:* Bognor and district, and Slindon (*Guermonprez*); Guestling (*Bloomfield*); Polegate (*Shaw*); East Grinstead (*Burr*); Hastings (*Shaw*). *Surrey:* Oxshott (*South*); Wimbledon and Dormans (*Burr*); Witley (*Dalgliesh*); Farnham District, Tilford, and Frensham (*Sopp*); Ashtead, Merrow Downs, and near Lower Malden (*Lucas*); Surbiton (*Goss*); Send (*Rawes*); Dorking (*Guermonprez*); Walton-on-Thames (*Annett*); near Guildford (*Cooper*); Bisley (*Ficklin*); Boxhill (*Briggs*). *Notts:* S. Leverton and Treswell Wood (*Thornley*); N. Leverton (*Shaw*). *Wilts:* West Wood near Marlborough (*Stowell*).

Wales.—*Carnarvonshire:* Penmaenmawr (*Porritt*).

Scotland.—*Wigtonshire:* One specimen, basking in the sun on a large flat boulder, above high-water mark and below the Garheugh Rocks, Luce Bay, about 3 p.m. on 15 Oct., after a severe storm. There are no trees within half a mile of the spot. (*J. G. Gordon*, 'Entom. Record,' 1906, p. 77.) This is the only well authenticated record of a Locustid grasshopper from Scotland.

Ireland.—*Cork:* Fermoy (*fide Kemp*). *Dublin:* Howth (*fide Kemp*).

Casual Locustids.

1. **Tachycines asynamorus** Adelung (= *Diestrammena marmorata* Haan).—In the 'Entomologist,' vol. xlvii, 1914, p. 145, I published a figure and notes on the occurrence of this large spider-like species, which occurred about 1912 in a nursery at S. Leonards. I had previously received it from Kew Gardens, and on 1 October 1913 received decomposing fragments of what I took to be other specimens, which were taken at Ipswich. This species is not unlikely to occur again under similar circumstances, and being apparently an animal feeder, might prove a useful insect.

2. **Gryllacris sp.**—A specimen was found on *Nepenthes* in propagating pits at Kew Gardens, 6 October 1897. Being a nymph the species remains undetermined.

3. **Tettigonia albifrons** Fabr.—One example of this large and handsome species was taken at Ramsgate in or about 1850 by Dorsitor, who gave it to E. W. Janson, whose son gave it to C. A. Briggs.

4. **Copiophora cornuta** De Geer.—One taken in a hot-house near Birmingham. McLachlan ('Entom. Soc. Proc.' 4 Nov. 1885) said that it was not the first time it had been taken in this country.

5. **Copiophora sp.**—In a hot-house at Lee. (Billups, 'Entom. Soc. Lond.' 5 February 1883.)

6. **Lirometopum brevirostre** Stål.—A full-grown specimen was found at Kew Gardens on the underside of the leaf of an unnamed aroid. It is a large brilliant green grasshopper with ovipositor of inordinate length. Though differing slightly from the typical form, it no doubt belongs to the species named. ('Kew Bulletin,' Additional Series, v, 1906.)

7. **Agrœcia vittipes** Redt.—One was taken in mid July 1902 at St. Albans, Hertfordshire. (W. P. Westell, 'Record,' 1902, p. 269.)

8. **Ducetia thymifolia** Fabr. (= *Phaneroptera privata* Walk.).—One was recorded in the 'Proceedings of the Entom. Soc. of London,' 1896, p. xvi, as taken at Merton Hall, Norfolk. It was identified as belonging to this species from the male type in the British Museum. Its origin is not known, but it is scarcely likely to occur again.

9. **Phaneroptera falcata** Scop. This is a pale green, slender Locustid of moderate size, with wings about a third as long again as the elytra, these being again a little longer than the body, which may reach a length of 18 mm. One specimen was taken by Dr. Mason in September 1881 at Porthgwarra near Land's End, at rest on the grass near a foot-path. In 1907 W. Daws of Mansfield sent me for inspection an insect which he took at Sennen Cove, 11 September 1884. He said that it was delicate-looking when fresh, with long antennæ, and that the wings were much longer than the elytra when closed. It reached me unfortunately in a very fragmentary condition, but it seemed without doubt to be *P. falcata*. There is, therefore, a chance of this insect being given a recognised position in our list, if some enterprising entomologist will search the Land's End district at the end of summer.

10. **Phaneroptera quadripunctata** Brunn.—This species was met with in some numbers in a vinery near Chester in 1905, and a living example was exhibited at the Entomological Society of London by Dr. Gahan, 18 October 1905.

(*Xiphidium fuscum* Fabr. has found its way into the older lists through a mistake, *C. dorsalis* having been taken for this species.)

Sub-order V. ACRIDIODEA.
(Short-horned Grasshoppers.)

Included in the Acridiodea are immense numbers of grasshoppers, which may be defined as: *Orthoptera with hind legs longer than fore or mid legs and having their femora wider towards the base; the "ear" on the first segment of the abdomen, at the side, towards the top, the "music" being produced by hind leg and elytron; antennæ short; tarsi with three segments; ovipositor not conspicuous, composed of four short valves.*

Females may be distinguished by the form of the external genital organs, there being an ovipositor of four valves, which project beyond the supra-anal plate and sub-genital lamina. In the male the sub-genital lamina is recurved and somewhat pointed, forming the apex of the abdomen.

We may divide the Acridiodea into nine families:

W.B.*	1. Tetrigidæ.	W.	6. Œdipodidæ.
	2. Pneumoridæ.	W.	7. Pyrgomorphidæ.
	3. Mastacidæ.	W.	8. Pamphagidæ.
	4. Proscopiidæ.	W.	9. Acridiidæ.
W.B.	5. Truxalidæ.		

Two only of these contain British representatives, the Truxalidæ and the Tetrigidæ—nine species being found in the former family, and two, belonging to the genus *Tetrix*, in the latter. The typical family, Acridiidæ, containing the migratory locusts, includes no species native to Britain. Though we possess so few species, and most of those that we do possess are small, yet they give a fairly good idea of the Acridiodea as a whole.

In some cases the eggs are elongated cylinders with rounded ends slightly curved in the long axis, but how far this is general in the group I cannot say. The

* W. means represented in Western Europe; B. means represented in Britain.

female, with the valvular processes at the extremity of her abdomen, excavates a hole in the soil and there places the eggs, providing them at the same time with a protective covering, thus giving a hint of relationship between the Acridiodea and the Blattodea, which, we have seen, place their eggs in a horny pouch. J. Künckel d'Herculais ('Comptes Rendus,' cxix, pp. 244–247) describes the method of egg-laying pursued by an Acridian grasshopper, and J. L. Hancock ('The Tettigidæ of North America') does the same for an American species of the genus *Tetrix*. After hatching there are some half-dozen ecdyses, the wings gradually developing as the insects grow to their full size. As in the preceding groups there is little post-embryonic development, the insects being nymphs from the time of hatching till they reach maturity. In this stage it is often not easy readily to distinguish one species from a nearly allied one.

Food appears to be in general of a vegetable nature. Most of our species eat grass, holding on to a blade with their legs and biting downwards along its edge. The Tetrigidæ, however, are something like earthworms in the nature of their food. They seldom browse off higher plants but confine their attention chiefly to lichens, mosses, and the surface-soil, which contains various forms of low plant-life.

To everyone the "song" of the grasshopper is familiar, and every naturalist will appreciate the words of the poet Keats, who says:

> "When all the birds are faint with the hot sun.
> And hide in cooling trees, a voice will run
> From hedge to hedge about the new-mown mead;
> It is the grasshopper's. . . ."

The chirp is produced by the rubbing together of the outer surface of the elytron and the inner surface of the hind femur. A series of small teeth on the latter scrape against a projecting vein on the former, and thus produce the sound, as may easily be tested experimentally with a recently killed insect.

How skilfully some grasshoppers, after one of their flying leaps, land unerringly on a slender grass-stem or similar object! This argues that their sight is of no mean order.

There is often some considerable difficulty in distinguishing allied species of the Acridiodea. In our

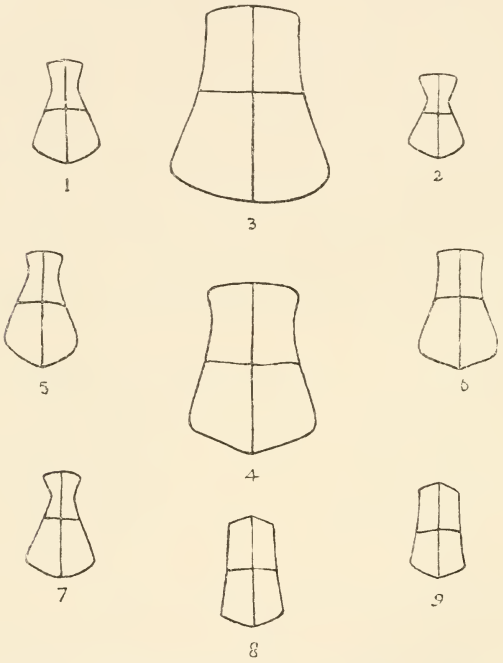


Fig. 22.—Pronota of British species of Acridiodea (except *Tetrix* Latreille) to show the arrangement of the three carinæ and the cross-furrow (× 5). 1. *Gomphocerus rufus* Linnæus. 2. *G. maculatus* Thunberg. 3. *Mecostethus grossus* Linnæus. 4. *Stenobothrus lineatus* Panzer. 5. *Omocestus rufipes* Zetterstedt. 6. *O. viridulus* Linnæus. 7. *Stauroderus bicolor* Charpentier. 8. *Chorthippus elegans* Charpentier. 9. *C. parallelus* Zetterstedt.

own examples there is usually great diversity of colour amongst individuals of the same species. Of *Stauroderus bicolor* it would scarcely be an exaggeration to say that no two are alike in colour. One feels certain, whatever may be the agency which brought about the result, that their colouring, wherever the surroundings

are sufficiently definite, assimilates—sometimes with wonderful accuracy—with such surroundings. *Chorthippus parallelus* also varies greatly : the other British members of the *Stenobothrus*-group do not appear to do so to the same extent, but perhaps this is only because I have met with them in fewer localities, or because the nature of their habitat is less varied. Of our two "club-horned" species, *Gomphocerus maculatus* varies as much as does *Stauroderus bicolor*, but *G. rufus* appears to be much more constant. Both the British species of *Tetrix* are also very variable in their colour and markings.

For this reason colour must be but little relied on for distinguishing species. In connection with classification the following are some of the points which are most useful, and it is chiefly on these that the accompanying identification table has been founded :

1. The foveolæ of the vertex—little depressions, often quadrangular, on each side of the vertex, or top of the head, between the eyes.
2. The median sulcus (depression) down the centre of the frons (containing the median ocellus), the two lateral ones being less useful.
3. The colour of the palpi.
4. The tip of the short antennæ, which never consist of more than 25 segments.
5. The position of the cross furrow of the pronotum.
6. The amount of bending and the position of the angle of each of the lateral carinæ of the pronotum.
7. The hind margin of the pronotum, which is usually very obtusely angled, but in the genus *Tetrix* is produced a long way backwards.
8. The presence or absence of a pad between the claws of the tarsi.
9. The presence or absence of a tooth at the base of the valves of the ovipositor.
10. The amount of development of the organs of flight in the imago.
11. The region of the elytra near the base, between the costa and the sub-costa, that between the sub-costal branches, and in some cases that between the medius and the cubitus.

In an elytron of a normal member of the Acridiodea, which is fairly typical of elytra and wings of the Orthoptera, the principal nervures are:

1. The *costa*, which constitutes the fore margin of the elytron.
2. The *sub-costa* in two branches.

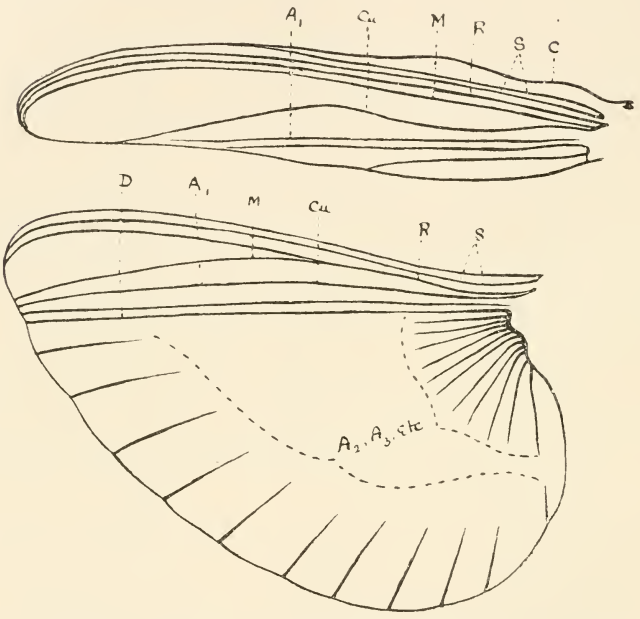


Fig. 23.—Elytron and wing of an Acridian grasshopper. Nervures: C, costa; S, subcosta; R, radius; M, medius; CU, cubitus; A_1, first anal; A_2, A_3, etc., remaining anal nervures; D, dividing nervure.

3. The *radius*, which, at the base, is closely associated with the sub-costa.
4. The *medius*.
5. The *cubitus*, which is closely associated with the medius at the base, the region between them being distinctive in one case—*S. lineatus*.
6. The *first anal* nervure, which is separate from the remaining anals.
7. Between the first and remaining anal nervures is the first anal fold (in which is developed in some Orthoptera the *dividing* nervure—not a primary one).

8. The rest of the *anal nervures* are closely associated with one another at the base of the elytron.

In the wing the costa is scarcely developed, and the first branch of the sub-costa becomes the marginal nervure. The medius appears to branch off from the radius some distance from the base of the wing. The dividing nervure is present. The second and succeeding branches of the anal nervure occupy the greater part of the wing-area. The wing is of less importance for distinguishing species than the elytron. The tendency to become rudimentary or abortive is much greater in the wing than in the elytron.

British Species of Acridiodea.

A. Pronotum not extending beyond thorax; a pad between the tarsal claws.
  (a). Foveolæ of vertex almost absent; species large . . . . . *M. grossus.*
  (b). Foveolæ of vertex well marked; species smaller.
    (i). Antennæ not clubbed.
      1. Tooth at base of valves of ovipositor; area between medius and cubitus of elytron large, with regular reticulation . . . *S. lineatus.*
      2. No tooth at base; less regular reticulation in a narrower area.
        (a). Costa unarched near base; area between costa and sub-costa extending far beyond middle of elytron.
          (i). Greenish; palpi coloured as face . . . . . *O. viridulus.*
          (ii). Partly ruddy; palpi white at tip . . . . . *O. rufipes.*
        (b). Costa arched near base; area between costa and sub-costa shorter.
          (i). Lateral carinæ of pronotum sharply angled . . . *S. bicolor.*
          (ii). Lateral carinæ nearly straight.

(α). Elytra and wings developed . . . *C. elegans.*
(β). Elytra abbreviated in female; wing abortive in both cases . . *C. parallelus.*

(ii). Antennæ clubbed.
1. Colour somewhat uniform brown; costa arched at the base; clubs pronounced, whitish at tip . *G. rufus.*
2. Smaller; spotted and varying much; costa unarched at base; clubs less pronounced; not white at the tip . . . . . *G. maculatus.*

B. Pronotum covering the abdomen; no pad between the tarsal claws; species very small.
(a). Stout; pronotum extending to tip of hind femora; ridge of pronotum elevated; two black spots sometimes present . . . . . *T. bipunctatus.*
(b). More slender; pronotum extending well beyond the tip of hind femora; ridge less pronounced . . . *T. subulatus.*

Genus 1. **TETRIX** Latr.

(Grouse Locusts.)

Gryllus Bulla Linn. Syst. Nat. (ed. x) i, p. 427 . . . . 1758.
Acrydium Geoff. Hist. Ins. i, p. 390 . . . . . 1762.
Acridium Schrank Fauna Boica, ii, p. 30 . . . . . 1801.
Tetrix Latr. Hist. Nat. Crust. Ins. xii, p. 161 . . . . 1804.
Tettix Charp. Germ. Zeitschr. Ent. iii, p. 315 . . . . 1841.

Amongst the smallest of the Orthoptera. Vertex, viewed from the side, more or less distinctly produced in advance of the eyes. Antennæ short, stout or slender, consisting of twelve to fourteen segments. Pronotum large, covering mesonotum, metanotum, and not infrequently reaching beyond the tip of the abdomen and the apex of the hind femora; lateral lobes two-angled behind. Elytra reduced to two small lobes or scales, situated in the hinder of the two angles of the flap of the pronotum. Wings may be large

and well developed. There are about four or five ecdyses, and the imago may sometimes perhaps live longer than one year.

By means of the table just given the two British species, when mature, may be distinguished without any difficulty.

1. **Tetrix subulatus** Linn.

(Plate XXI, fig. 2; Pl. XXIII, fig. 1; and Fig. 24 in text.)

subulatus	Linn. Syst. Nat. (ed. x), tom. i, p. 428, n. 18	1758—*Gryllus Bulla.*
,,	Linn. Faun. Suec. (ed. ii), p. 236, n. 865	1761—*Gryllus.*
subulatum	De Geer Mém. Ins. iii, p. 484, n. 12	1773—*Acrydium.*
,,	Schrank Fauna Boica, ii, p. 32, n. 1022	1801—*Acridium.*
subulata	Latr. Hist. Nat. Crust. Ins. xii, p. 164, n. 2	1804—*Tetrix.*
subulatum	Curtis Brit. Entom. n. 439 . .	1833—*Acrydium.*
subulata	Charp. Germ. Zeitschr. Ent. iii, p. 315	1841—*Tettix.*
subulatus	Brunner Prod. der. Eur. Orth. p. 237, f. 56 c	1882—*Tettix.*
subulata	Finot Faune de la Fr., Orth. p. 167, pl. viii, f. 116	1889—*Tetrix.*
subulatus	Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 454	1889—*Tettix.*
,,	Burr Brit. Orth. p. 47, pl. iv, f. 3 .	1897—*Tettix.*
,,	Lucas Entomologist, p. 165, ff. 1, 2	1901—*Tettix.*
,,	Burr Syn. Orth. W. Eur. p. 77 .	1910—*Tettix.*
Subulatum	Kirby Syn. Cat. Orth. iii. p. 36 .	1910—*Acrydium.*
subulatus	Lucas Proc. S. Lond. Ent. Soc. p. 33, pl. iv, f. 11	1913—*Tetrix.*

(Other synonyms: *A. bipunctatum* Panz.; *T. panzeri* St. Farg & Serv.; *A. bimaculatum* Zett.; *A. dorsale* Zett.; *T. marginata* St. Farg & Serv.; and *G. striatus* Gmel. For a long list of varietal names see Kirby, 'Syn. Cat. Orth.' iii, pp. 37–39.)

Original Description.

subulatus. 18. G. B. thoracis scutello abdomine longiore.
Fn. svec. 624. Gryllus elytris nullis, thorace producto abdomine longiore.
Habitat in Europa *ad fossas et aquas stagnantes.*
(C. Linnæus, 'Syst. Nat.' tom. i, p. 428, 1758.)

865. GRYLLUS *subulatus* thoracis scutello abdomine longiore.
Gryllus elytris nullis, thorace producto abdomine longiore.
Fn. 624.

Habitat in pratis ad fossas et aquas stagnantes, primo vere.
Descr. Statura præcedentis [i. e. *bipunctatus*] sed angustior et *Thoraæ* scutellaris ipso corpore fere duplo longior. *Antennæ* breves.
(C. Linnæus, 'Fn. Suec.' p. 236, 1761.)

Male Imago.—General *colour* very dark brown (but it varies a great deal), marked and mottled at times with lighter or darker tints. *Build* slender. *Length* some 9–12 mm. *Vertex* produced in an obtuse angle; *eyes* closer than in *T. bipunctatus*; *pronotum* flatter; very attenuated posteriorly, and reaching much beyond the apex of the hind femora; median carina not much raised, especially behind. The pronotum sometimes has the two black spots from which the next species is named. *Elytra* reduced to tiny pads; but wings ample, as long as the pronotal process. The arrangement of the nervures in the wing is, however, abnormal. In front of the dividing nervure the wing is much chitinised and compressed, so that the nervures are brought together, the subcosta, radius, and medius being fused in the middle, and the cubitus greatly suppressed: it is not easy to distinguish them.

Female Imago (Fig. 24).—In this sex there is more variation in colour than in the male. The female, too, is appreciably larger. *Valves of the ovipositor* are similar to those of *T. bipunctatus*.

Nymph.—In addition to the feebler texture, the pronotal extension is shorter, and there is but one sinus to the hind border of the side flap of the pronotum.

Variation.—*T. subulatus* varies greatly both in size and in colouring, especially in the female; the male is dark and more constant in the New Forest where I have had most experience of the species. There is a well-marked form of the female with a circular whitish patch on the broad fore part of the pronotum, the rest of the upper surface being mottled with dark and yellowish brown. Some specimens have a lighter stripe down the pronotum. Azam mentions a var.

sahlbergi Saulcy, with short wings and pronotum. A nymph was taken in the New Forest, with the circular whitish patch on the pronotum: this had immature dark wings and a very short pronotum. So possibly var. *sahlbergi* is a nymph. A prettily coloured specimen of a greenish tint was taken on one occasion.

Date.—Judging by my own experience this species appears to be in the nymphal condition till well into August, after which imagines may be taken rather freely. This points to the fact that, like its commoner

Fig. 24.—*Tetrix subulatus* Linnæus (× 3·25). The form with pale pronotum, bearing two spots as in *T. bipunctatus* Linn.

congener, it passes the winter as an imago, and that the eggs are laid in the spring—probably about May. That it *does* hibernate as an imago I was able to establish in 1918. On 27 April I visited a locality in which I knew these grasshoppers to occur and found them present in large numbers. In all 23 specimens were taken, almost promiscuously, and put in a laurel-bottle. On examining them afterwards all were found to be adult—16 females and 7 males. (The difference in numbers of the two sexes may mean little, as the males are very small and inconspicuous.)

Habits, etc.—At Marlborough Deeps in the New Forest (apparently a long-disused marl-pit of great extent) *T. subulatus* occurs rather freely in wet places, where a great deal of moss and similar vegetation is

found on the soil. There it is best captured by sweeping, though I suspect that the insect, which is very obscure and difficult to see, is captured as it jumps in front of the net. Should one be sighted, it is not at all an easy matter to hunt it down, so closely does it resemble a particle of soil when it alights upon the ground. On a landslip on the shore near Milton (Hants) where it occurs, the soil is also of a marly nature. Shaw took it on the landslip at Charmouth. Burr once took a specimen which was swimming on the surface of a sluggish stream that was full of animal life. At first he could scarcely imagine what it was, for its motion was entirely different from that of the common surface insects. It had doubtless fallen in by accident, and was swimming towards the shore with powerful strokes of its hind legs. Other Acridian grasshoppers use their hind legs on occasion for swimming in the same way. It is worth noting that I discovered the presence of this grasshopper at Marlborough Deeps, in consequence of a specimen jumping into the water as I passed one of the numerous ponds to be found in that locality. An example from this place taken on 20 August was kept alive for a long time. Damp *Sphagnum* was in the box with it, and I gave it no other food. It was quite lively, when examined on 22 December, but was dead when I looked at it on 3 January following. Possibly it might have survived the winter had it been allowed to hibernate properly out of doors.

After the above was written I had the following experience of the species in the spring of 1918, when I re-visited Marlborough Deeps on purpose to search for it. I found the grasshoppers very commonly on ground rather sparsely covered with short grass and other small vegetation amongst the ponds and damp places. All appeared to be mature. In the bright sunshine they got up on the wing in all directions, and flew two or three yards, or even more, at a time. Apparently they did not use their wings if a cloud

passed over the sun. As they could turn in the air, they were employing their wings for true flight. They did this to avoid some object, or the water, as it appeared, although they seemed fairly well at home in the latter element. They swam quite well, even under the surface, propelling themselves by means of their hind legs. As I had no net, I captured them by hand, but found it a difficult matter to follow them (particularly the small dark males) more especially as little black spiders were running on the ground, little black flies were flitting over it, and other small insects kept rising up from it. I fancy (but am not certain) that when they are followed the flight of these grasshoppers becomes less and less strong. They varied greatly in colour and conspicuousness. In the form with the pale disc on the fore part of the pronotum, var. *stylifer* Luc., the colouring is really due to the pale tint of the pronotum being interrupted by two large black triangular spots, similarly situated to those from which *T. bipunctatus* derives its name.

Distribution.—This little grasshopper is widely distributed in Europe—England, Holland, Belgium, France, Alps, Pyrenees, and Spain at least. It also occurs in Asia (*Kirby*).

British Localities.

Judging by the records *T. subulatus* is an uncommon insect in Britain. So inconspicuous is it, however, that it may only be awaiting investigators to put it on a much better footing.

England.—*Berks:* Neighbourhood of Radley College (*Burr*). *Cambridgeshire:* Cambridge (Hope Coll., Oxford); Wicken and Burwell Fens (*Morley*). *Cornwall:* Padstow (*Lamb*); Newquay (*Burr*); Widemouth Bay near Bude (*Bracken*). *Devon:* Bignall considered that it was generally distributed, but Bracken does not find it so now. He says: "*T. bipunctatus* is common everywhere here [presumably near Plymouth] but *T. subulatus* rarely occurs. Mr. J. H. Keys has given me one taken at Nodder Bridge (near Plymouth but on the Cornish side of the Tamar) 24 April 1915. All

my previous captures were made at Bude and Braunton Burrows." *Dorset*: Glanvilles Wootton (*J. C. Dale*); Studland (*Yerbury*); landslip near Charmouth (*Shaw*). *Gloucestershire:* (*Edwards*). *Hants:* Coast near Milton (*Lucas*); New Forest—Holmsley (*Piffard*) and Marlborough Deeps (*Lucas*); Barton (*Edwards*) (perhaps the Milton locality). *Huntingdonshire:* Whittlesea Mere (*J. C. Dale*). *Kent:* Folkestone Warren (*Burr*). *Norfolk:* (*Edwards*); Broads (Stalham) (*Porritt*). *Suffolk:* Mildenhall (*Perkins*); Tuddenham Fen (*Morley*). *Surrey:* Dormans near East Grinstead (*Burr*).

Ireland.—*Limerick;* (*fide Kemp*).

2. **Tetrix bipunctatus** Linn.

(Plate XXI, fig. 1.)

bipunctatus	Linn. Syst. Nat. (ed. x), p. 427, n. 17	1758—*Gryllus Bulla.*
„	Linn. Faun. Suec. (ed. ii), p. 235, n. 864	1761—*Gryllus.*
bipunctatum	Fabr. Syst. Ent. p. 278, n. 1 .	1775—*Acrydium.*
„	Schrank Fauna Boica, ii, p. 32, n. 1023	1801—*Acridium.*
bipunctata	Latr. Hist. Nat. Crust. Ins. xii, p. 164, n. 1	1804—*Tetrix.*
bipunctatum	Curtis Brit. Entom. n. 439 .	1833—*Acrydium.*
bipunctata	Fieb. Abh. Böhm. Ges. (5), iii, p. 411, n. 4, pl. x, ff. 14–16 .	1844—*Tettix.*
bipunctatus	Brunner Prod. der Eur. Orth. p. 235	1882—*Tettix.*
bipunctata	Finot Faune de la Fr., Orth. p. 166	1889—*Tetrix.*
bipunctatus	Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 454 . . .	1889—*Tettix.*
„	Burr Brit. Orth. p. 44, pl. iv, f. 2	1897—*Tettix.*
„	Lucas Entomologist, p. 165, pl. iii, ff. 1*a*, 2*a*. . . .	1901—*Tettix.*
„	Burr Syn. Orth. W. Eur. p. 76	1910—*Tettix.*
Bipunctatum	Kirby Syn. Cat. Orth. iii, p. 39	1910—*Acrydium.*
bipunctatus	Lucas Proc. S. Lond. Ent. Soc. p. 32, pl. iv, f. 10 . . .	1913—*Tetrix.*

(Other synonyms are: *A. scutellatum* De Geer; *A. xyphothyreum* Schrank; *T. schrankii* Fieb.; *A. opacum* Herbst; *A. gybbum* Oliv.; *A. ephippium* Zett.; *A. binotatum* Zett.; *T. obscura* Hagenb.; *A. cristatum* Zett.; *A. lunulatum* Thunb.; *T. nutans* Fieb.; *T. linnei* Fieb. For a long list of varietal names see Kirby 'Syn. Cat. Orth.' iii, pp. 40–42.)

Original Description.

bipunctatus. 17. G. B. thoracis scutello abdominis longitudine.

Fn. svec. 623. Gryllus elytris nullis, thorace in elytron longitudinale extenso macula utrinque nigra rhombea.
Habitat in Europa.
(C. Linnæus, 'Syst. Nat.' ed. x, tom. i, p. 427, 1758.)

864. GRYLLUS *bipunctatus* thoracis scutello abdominis longitudine.
Gryllus elytris nullis, thorace in elytron longitudinale extenso macula utrinque rhombea nigra. Fn. 623.
Habitat in pratis siccioribus.
Descr. Est species e minimis hujus generis. Manifeste distinguitur scuto *Thoracis* producto ad longitudinem abdominis, linea longitudinali elevata, et punctis duobus oppositis atris rhombeis, sæpe in medio longitudinis. *Alæ* albæ sub hac crusta absconduntur. *Antennæ* breviores sunt in hac, quam in alia ulla. *Elytra* e thorace producto longitudine abdominis.
(C. Linnæus, 'Fn. Suec.' p. 235, 1761.)

Male Imago.—*Colour* brown, of a wide range of tints, extending almost from white to black; variously marked and mottled; surface rugose; build stout. *Length* (including pronotum) 7·5–11 mm. *Vertex* produced between the eyes in a broad obtuse angle; eyes rather distant. *Frons* having a longitudinal median sulcus with raised edge, the median ocellus being at its forward end. *Antennæ* short and slender. *Pronotum* narrow in front, wider above the wings, then narrowing, and ending bluntly, but reaching the tip of the abdomen; median carina raised considerably; two black spots sometimes present just behind the widest part (whence the specific name); side flaps bisinuate behind. *Elytra* reduced to tiny pads, situated in the more dorsal sinus of the pronotal flaps. *Wings* quite small and probably useless as organs of flight. *Prosternum* produced a little in front. *Hind femora* stout. No pad between the tarsal claws.

Female Imago (Plate XXI, fig. 1).—In appearance much like the male. Wings much more reduced. Valves of the ovipositor rather long, rough, and finely toothed.

Nymph.—In addition to its softer texture, the pronotum is shorter but has a more elevated median carina. The lateral flaps of the pronotum are simply curved behind, and not bisinuate.

Eggs and Egg-laying.—Information about our two species is not forthcoming on this point. Hancock has investigated the matter with regard to one or two American species. The eggs were slightly curved in their long axis, about one-third as wide as long; they terminated in a long process, so as to resemble a club with a short handle; they were pinkish-white when laid, but turned to an opaque greenish-yellow-white. The eggs were laid side by side in a pear-shaped mass glued together, the processes being upwards. The female made a shallow hole by spreading and closing her ovipositor blades, and by lengthening her abdomen, the hind legs being drawn up out of the way. It took about one hour to lay the eggs, which were not numerous —about a dozen more or less. After the process was finished the earth was scraped over the spot. When the opportunity arises it will be interesting to see whether the British species proceed in a similar way.

Variation.—Like *T. subulatus*, this little grasshopper varies enormously in size, and still more than that species in colour. The range is from practically black, through dark brown, dull red, and lighter browns, to a dirty white. There may be in addition various markings and mottlings. A conspicuous form has a broad yellowish-white mid-dorsal stripe. The two black spots on the pronotum, from which the species derives its scientific name, may be conspicuous, indistinct, or absent. A very dark example, with pronotum extending a little beyond the tip of the hind femora, taken by Yerbury at Nethy Bridge, looked remarkably like *T. fuliginosus* Zett., but was not. This should be British, but the moment of its discovery has not yet arrived. Burr states that a fully-winged form has been taken in France. Fieber figured and described the nymph as *schrankii*, the distinction depending chiefly on the one-lobed hind margin of the side-flaps of the pronotum; but Brunner points out that this is a characteristic of all the species in the nymph-stage. Dr. Buchanan White recorded *schrankii* for Scotland in 1870.

Date.—Probably the eggs are laid about May. The nymph-stage lasts during the early part of the summer, and imagines begin to be found during August. These hibernate and appear again at least as early as March; possibly they get about in genial weather before that month. Nymphs may be found even after August. On one occasion I saw an imago in the New Forest resting on a leaf on 3 September. By its side was the empty skin—a pale ghostly image of the nymph as these grasshopper sloughs always are. The change had taken place so recently that the imago was scarcely strong enough to leap.

Habits, etc.—*T. bipunctatus* is usually found in drier places than its congener. It may be expected in woods amongst dry leaves, amongst short grass in clearings of woods, on moorland and hillside slopes, on sand-hills, etc. Personally I think the most likely spot in which to look for it is a warm margin of a wood, where the soil is only partly covered with vegetation. Such a spot serves to hide it admirably, for it does not jump on to stems of grass or other vegetation, but alights on the ground, where it need scarcely be said that its colouring conceals it effectually. I once saw a specimen swimming in the water standing in a cartrut near Oxshott in Surrey. Presumably it had hopped into the water and was swimming out again. Morley mentions two "flying in sunshine" at Bentley Woods in Suffolk. This might be expected of *T. subulatus*, but the size of the wings seems to preclude the possibility in the case of *T. bipunctatus*. This grasshopper may be taken by sweeping, presuming it has not taken up its abode where brambles occur, as it so often does. It is not, however, so small as to make stalking and hand-capture a very difficult matter.

Distribution.—This *Tetrix* is found over nearly the whole of Europe, including Lapland, Norway, Holland, Belgium, England, France, Spain, Portugal, Italy. It also occurs in Asia Minor, Siberia, and Amur.

British Localities.

T. bipunctatus is one of our common grasshoppers, occurring in all four divisions of the United Kingdom. The list of localities is therefore somewhat lengthy.

England.—*Berks:* Wantage and Tubney (*Holland*); Streatley (*Tomlin*); neighbourhood of Radley College (*Burr*); Battersea (*Samouelle*). *Cheshire:* Caldy, Hartford, Hoylake District, Wallasey, and West Kirby (*Sopp*). *Cornwall:* Padstow (*Lamb*); Quintrel Downs Newquay (*Edwards*); Widemouth Bay near Bude, Wanson Mouth near Bude, and Watergate Bay near Newquay (*Bracken*); Shierock (*Yerbury*). *Cumberland:* Fairly general (*Day*); Orton (*Day*). *Derbyshire:* Common in Bretby Park (*Brown*). *Devon:* Generally distributed (*Bracken*); Plympton near Plymouth, Shaugh Bridge, Walkham Valley, Newnham near Plympton, Lee Woods near Woolacombe, and at Cawsand (Cosden); Beacon in sheltered hollows at the foot of the tor (*Bracken*); Rockford (*Briggs*). *Dorset:* Goathorn Peninsula (with rather long pronotum), and Studland (*Yerbury*). *Essex:* Epping Forest (*Ansorge*). *Gloucestershire:* (*Edwards*); Cotswolds near Painswick (*Edwards*). *Hants:* New Forest, near Christchurch, coast near Milford (*Lucas*); Pamber (*Tomlin*); Hayling Island (*Guermonprez*); near Eastleigh (*Edwards*); Aldershot (*Sopp*); Barton (*Edwards*). *I. of Wight:* Parkhurst Forest, Compton Bay, and on the Undercliff (*Burr*); Marvel (*Morley*). *Herefordshire:* West Malvern and Whitbourne (*Tomlin*). *Kent:* Wye (*Porritt*); Faversham District (*Chitty*); Orford (*South*); Darenth (*Sharp*). *Lancashire:* Ainsdale (*Coward*); Ormskirk (*Score*); Scarisbrick (*Chaster*); Alithwaite, Ayside, Birkdale, Cark-in-Cartmel, Cartmel, Grange-over-Sands, Hightown, Holker, Kent's Bank, Lindale, Newton-in-Furness, Silverdale, and Southport (*Sopp*). *Leicester:* (*Porritt*). *Lincolnshire:* Manton Common and Scotton Common (*Peacock*); Grantham (Records Lincs. Nat. Union); Market Rasen (*Cassal*); Gurnhills Wood, Ashby, and Skellingthorpe (*Shaw*); Mumby Chapel (*Mason*); Alford, and Greenfield Wood near Alford (*Woodthorpe*); Linwood Warren (*Thornley*). *I. of Man:* Lonan (*Shaw*); Ballaugh (*Cassal*). *Middlesex:* Harrow Weald (*Priske*). *Norfolk:* (*Edwards*); Ormesby Parish (*B.-Browne*); Broads, apparently Stalham (*Porritt*). *Notts:* Retford (*Pegler*); Burton Joyce (*Carr*). *Oxon:* Near Henley-on-Thames (*Scott*). *Suffolk:* Ipswich District, Woodbridge, Dodnash Wood, Lakenham Heath, Barnby Broad, Assington Thicks, Lakenham Marshes,

and Bentley Woods (*Morley*); Yarmouth (*Paget*). *Surrey:* Bookham Common, Boxhill, Esher Common, Oxshott, Ockham Common, Horsley, and near Netley Heath (*Lucas*); Roy. Hort. Soc. Gardens, Wisley (*Wallis*); Farnham District (*Sopp*); Byfleet (*Porritt*); Dorking (*Guermonprez*). *Sussex:* East Sussex (*Porritt*); Slindon and Dale Park (*Guermonprez*); Forest Row and Ashdown Forest (*Burr*); St. Leonards (*Ansorge*); Hailsham (*Porritt*); Guestling (*Bloomfield*). *Yorkshire:* Levisham near Newtondale (*Porritt*).

Wales.—*Pembrokeshire:* (*Jones*). *South Wales:* (*Chitty*).

Scotland.—*Argyll:* Oban (*Evans*). *Arran:* Brodick (*Evans*). *Dumbartonshire:* Peaton, Loch Long (*Evans*). *Dumfriesshire:* Ellangowan District (*McGowan*). *Elginshire:* Forres (*Chitty*); Brodie (*Yerbury*). *Fife:* West Wemyss and Thornton (*Evans*). *Haddingtonshire:* Saltoun (*Evans*). *Inverness-shire:* Strathglass (*Briggs*); Upper Glen Spean (*Evans*); Nethy Bridge (*Yerbury*); Abernethy Forest and Banks of Nethy (Cambridge Univ. Museum). *Nairnshire:* Nairn (*Yerbury*). *Orkneys:* Hoy (*McArthur*). *Perthshire:* Lockard, Muthill, Callander, Aberfoyle, Loch Chon, and Blair Athol (*Evans*). *Rannoch:* On the Moors, and Rannoch (*Porritt*). *Sutherland:* Lochinver (*Yerbury*). The species is widely distributed and not uncommon in Scotland, except in the Lowlands, where it is seldom met with. It was recorded from Forfarshire by G. Don in 1813, and Dr. Buchanan-White recorded it under the name of *T. schrankii* from Ross-shire, Inverness-shire, and Kircudbrightshire (*Evans*).

Ireland.—*Armagh:* Ardmore (*fide Kemp*). *Galway:* Recess (*fide Kemp*). *Kerry:* Glengariff and Kenmare (*fide Kemp*). *Wexford:* Killoughrum (*fide Kemp*).

Genus 2. **GOMPHOCERUS** Thunb.

Gomphocerus Thunb. Mém. Acad. Pétersb. v, p. 221 . . : 1815.

Gomphocerus differs from *Stenobothrus* Fisch. (*vide infra*) by the apex of the antennæ being clubbed, and the first segment of the abdomen having a more or less open tympanum. Type of genus *G. rufus*. Our two species, which are not at all alike, may readily be separated by the table on p. 206.

1. **Gomphocerus rufus** Linn.

(Plate XIX, fig. 1; Pl. XX, fig. 2; Pl. XXIII, figs. 4 and 5.)

rufus	Linn. Syst. Nat. (ed. x), i, p. 433, n. 57	1758—*Gryllus Locusta.*
„	Linn. Faun. Suec. p. 239, n. 876 .	1761—*Gryllus.*
clavicorne	De Geer Mém. Ins. iii, p. 482, n. 10, pl. xxiii, f. 13 . . .	1773—*Acrydium.*
rufum	Oliv. Enc. Méth. Ins. vi, p. 230, n. 66	1791—*Acrydium.*
rufus	Thunb. Mém. Acad. Pétersb. v, p. 221	1815—*Gomphocerus.*
„	Brunner Prod. der Eur. Orth. p. 131	1882—*Gomphocerus.*
„	Finot Faune de la Fr., Orth. pp. 131, 132, pl. vii, f. 95 . .	1889—*Gomphocerus.*
„	Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 419 . . .	1889—*Gomphocerus.*
„	Burr Brit. Orth. p. 39, pl. iii, f. 8	1897—*Gomphocerus.*
„	Burr Syn. Orth. W. Eur. p. 48 .	1910—*Gomphocerus.*
Rufus	Kirby Syn. Cat. Orth. iii, p. 156	1910—*Gomphocerus.*
rufus	Lucas Proc. S. Lond. Ent. Soc. p. 32, pl. iv, f. 8	1913—*Gomphocerus.*

Original Description.

rufus. 57. G. L. thorace cruciato, corpore rufo, elytris griseis, antennis subclavatis.
Fn. svec. 629. Gryllus antennis subclavatis acutis.
Habitat in Europa.
(C. Linnæus, 'Syst. Nat.' (ed. x), tom. i, p. 433, 1758.)

876. GRYLLUS *rufus* thorace cruciato, corpore rufo, elytris griseis, antennis subclavatis.
Gryllus antennis subclavatis acutis. *Fn.* 629.
Habitat in pratis *Roslagiæ.*
Descr. Est inter minores, non minimos. Totus rufus. *Thoracis* anguli nigri lineola alba. *Femora* rubra. *Elytra* grisea, immaculata. *Antennæ* clavatæ, ut in Papilionibus diurnis, sed tamen apice parum elongatis, et summo apice exalbidis.
(C. Linnæus, 'Faun. Suec.' p. 239, 1761.)

Male Imago (Plate XXIII, fig. 5).—General *colour* reddish-brown, with but few markings. *Length* some 14 mm. *Vertex* produced in a triangular form between the eyes; *foveolæ* of the vertex small; median *sulcus* of the frons scarcely extending above the ocellus; *antennæ* long, strongly clubbed, and then produced to a white tip. *Pronotum* with lateral carinæ obtusely angled in

front of the cross furrow, which is about half-way between the front and hind margins; usually two longitudinal black lines interrupted by the oblique lateral carinæ. *Elytra* (Pl. XX, fig. 2) well developed, almost uniform pale brown; costal nervure arched near the base; area between costa and first sub-costa extending three-quarters of the elytron. *Wings* fully developed, tinged with brown towards the apex. *Abdomen* yellow below.

Female Imago (Plate XXIII, fig. 4).—*Colour* much as in the male. *Length* 17–20 mm. *Antennæ* shorter, clubs far less pronounced than in the male. *Elytra* and *wings* not quite reaching the tip of the abdomen. Valves of the *ovipositor* short.

Egg.—Roughly cylindrical. It is somewhat rounder at one end, while the other turns slightly to one side. *Length* 4 mm. It appears to be not quite circular in section, the width in one direction being 1 mm., at right angles to it 0·9 mm. The examples examined were extracted from a dead female and put in weak spirit, so the natural colour is uncertain. The surface was a little wrinkled transversely, but this was perhaps due to the spirit.

Variation.—*G. rufus* seems to be rather constant in its colouring. In each sex there may be a cream-coloured mid-dorsal stripe on the thorax.

Date.—August and September seem to be the months when this grasshopper may most certainly be found mature; but Chapman has taken it in Surrey as late as 31 October. I might add that I have found nymphs, also in Surrey, as late as 9 September.

Habits, etc.—Dry grassy banks, grassy hill-sides, clearings in woods, and similar spots seem to constitute the habitat of this grasshopper. Where it occurs the clubbed antennæ—dark club with white tip—are quite easily noticed, especially in the male, though the rather short elytra of the female are inclined to suggest *C. parallelus*. The one haunt in which I know it best

is a spot of no great extent by the side of one of a string of ponds on Bookham Common in Surrey. On one occasion I brought home alive two nymphs and three imagines from this place. It was on the 9th of September; and on the morning of the 14th one nymph was found to have cast its skin and become a mature female, and judging by its appearance the change had occurred but a short time before the imago was noticed. These were fed on grass. Several examples put into a laurel-bottle, with perhaps a spot or two of benzine, were of a brilliant crimson colour when removed a day or two later, and this tint to some extent they retained when dry.

DISTRIBUTION.—*G. rufus* seems to be generally distributed in northern and central Europe, it having been recorded from England, Belgium, France, Scandinavia, Lapland, and Italy at least. Siberia has also been given as a locality.

BRITISH LOCALITIES.

This grasshopper is not common with us; in fact it has been recorded from seven English counties only.

ENGLAND.—*Berks:* (*Hamm*). *Devon:* Wembury and Bolt Head (*Bignell*); Dawlish and sandhills at Exmouth (*Parfitt*). *Gloucestershire:* Colesbourne (*Edwards*). *Hants:* C. W. Dale says his father took it at Lyndhurst in the New Forest in 1827 and 1830. I have not met with it in the Forest myself. *Kent:* Burr reported it from Folkestone Warren, but said it seemed to have disappeared on a later occasion; Maidstone (*Shaw*); Sheppey (*Burr*). *Surrey:* Bookham Common, the Sheepleas at Horsley, and between Denbies and Pickett's Hole (*Lucas*); Compton (*Edwards*); Leatherhead (*Burr*); Boxhill (*Briggs*); Reigate (*Billups*); Redhill (*Frisby*); Colley Hill, Dorking, and Buckland (*Chapman*); Battersea Fields early in the 19th century by Samouelle (*C. W. Dale*); Oxshott (*Burr*; but I have not met with it there). Dr. Chapman found the species in suitable spots on the southern slope of the North Downs from Reigate to Pickett's Hole, sometimes quite commonly. A Buckland locality, where he knew the species previously but where the insects are scarce, is part of the same slope of the North Downs several miles to the east.

No doubt further search would reveal a still more extended habitat in that district of Surrey. *Sussex:* Linchdown, Goodwood, and Eartham (*Guermonprez*).

2. **Gomphocerus maculatus** Thunb.

(Plate XIX, fig. 2; Pl. XX, fig. 3; Pl. XXIII, figs. 2 and 3.)

maculatus	Thunb. Mém. Acad. Pétersb. v, p. 221	1815—*Gomphocerus.*
biguttatus	Charp. Hor. Ent. p. 166 . . .	1825—*Gryllus.*
maculatus	Brunner Prod. der Eur. Orth. p. 132	1882—*Gomphocerus.*
„	Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 420	1889—*Gomphocerus.*
„	Finot Faune de la Fr. Orth. pp. 131, 133	1889—*Gomphocerus.*
„	Burr Brit. Orth. p. 40. pl. iii, f. 10 .	1897—*Gomphocerus.*
„	Burr Syn. Orth. W. Eur. p. 48 .	1910—*Gomphocerus.*
Maculatus	Kirby Syn. Cat. Orth. iii, p. 157 .	1910—*Gomphocerus.*
maculatus	Lucas Proc. S. Lond. Ent. Soc. p. 32, pl. iv, f. 9	1913—*Gomphocerus.*

(Other synonyms: *S. antennatus* Friv.; *Œ. pulla* Fisch.-Waldh.; *S. sausurii* Seaone. Stephens names three forms—*elegans*, *ericetarius*, and *calidoniensis*.)

Original Description.

G. maculatus: fuscus, viridi-variegatus.
Habitat in Svecia.
Similis G. rufo, sed distinctus Elytris fuscis, supra linea virescente, lateribus maculis albidis plurimis.
Femora supra viridia, lateribus grisea, nigro maculata.
Tibiae cinereae spinis nigris.
A. capite ad apicem thoracis saepe linea rubra.
(Thunberg, 'Mém. Acad. Pétersb.' v, p. 221, 1815.)

Male Imago (Pl. XXIII, fig. 2).—Small. *Colouring* very various, but in general presenting a very spotted appearance. *Length* some 13 mm. *Antennæ* less clubbed than in *G. rufus*, and without the white tip; *foveolæ* of the vertex deep; *median sulcus* of the frons small; vertex produced as a triangle between the eyes. Cross-furrow of the *pronotum* at about the middle; lateral carinæ deeply angled about the middle of the prozona and each crossed by an interrupted longitudinal black streak. Spotted *elytra* (Pl. XX, fig. 3), with

the costal margin unarched at the base ; region between radius and cubitus containing some white spots. *Wings* smoky at the apex. *Hind femora* variegated.

Female Imago (Pl. XXIII, fig. 3).—*Colour* in general like that of the male. A larger insect, its length being some 15–16 mm. *Elytra* reaching the tip of the abdomen. *Antennæ* shorter than in the male, and almost imperceptibly clubbed. Valves of the *ovipositor* short.

Variation.—These grasshoppers display an almost endless range of colour-variation. Some are richly spotted with cream, green, red, and various shades of brown. Some again are nearly black. Others, when the elytra are closed, have a conspicuous pale stripe along the back. At Trebarwith in Cornwall, Bracken found them almost without exception various shades of brown, but at Ugborough and Lee Woods in Devon they were nearly all black. They were dark generally on the S. Devon moorland margin, while those met with near the sea were pale. On dark soil in the New Forest, not yet covered with vegetation after a fire, one or two very dark specimens were noticed, while bright colours appeared to be absent ; amongst heather on the other hand they are sometimes very prettily marked with crimson and green. Evans found them almost black where heather had been burnt in Dumbartonshire. High on the screes of limestone rock in Dovedale, Jourdain noticed that they harmonised wonderfully with their surroundings. In fact, however brought about, assimilation to the environment is undoubtedly the result of the great range of colouring.

Date.—*G. maculatus* has a longer life as an imago than most of our Acridian grasshoppers, in that it may usually be found mature in the latter half of June. July, August, and September are the best months for it ; but it lives on into October, the latest date I have being 26 October in 1918.

Habits, etc.—Heaths, moors, and downs, especially

where the land is lying waste, with upland pastures and rocky ground, are some of the spots in which this common little grasshopper may be found. Owing to the close assimilation of its colouring to its surroundings, already referred to, it is probably more common even than it appears to be. The high degree of "protective resemblance" it exhibits is worthy of closer study. Kirby in the 'Text-book of Entomology,' p. 87 (1885), gives an account of the courtship of this insect, and Brock also gives an interesting account of an observation he made on the same subject in the 'Entomologist' for 1914, pp. 104, 105.

Distribution.—*G. maculatus* is found in northern, western, and central Europe, records being to hand from Lapland, Norway, Sweden, Holland, Belgium, Great Britain, Ireland, France, Germany, Austria, Serbia, and Spain at least. It also occurs in Asia.

British Localities.

Unlike its congener *G. rufus*, this grasshopper has been reported from a large number of localities in the British Isles. Still there are thirteen English counties that appear to be without a record.

England.—*Berks:* Besselsleigh and Tubney (*Hamm*). *Bucks:* Pitstone (*Mrs. G. J. Ashby*); East Burnham Common (*Campion*). *Cambridgeshire:* Devil's Ditch, Newmarket Heath (*J. C. Dale*); Wicken (*Porritt*). *Cheshire:* Thurstaston (*Coward*); Hoylake District and Bidston (*Sopp*). *Cornwall:* Fowey (*Stowell*); Trebarwith (*Bracken*); The Lizard (*Shaw*); Scilly Isles ('Entomologist,' 1872, p. 4, as *biguttulus*). *Cumberland:* Salkeld and Wan Fell near Penrith (*Day*). *Derbyshire:* Little Eaton and Breadsall Moor (*Pullen*); Lathkill Dale (*Jourdain*); Dovedale (*W. E. Evans*). *Devon:* Lynmouth and Linton (*Briggs*); near Dawlish (*Lucas*); Dartmoor (*Shaw*); between Exeter and Budleigh Salterton, as *biguttulus* (*Kirby*); Wembury and Torcross (*Bignell*); Haldon, Woodbury, and Blackdown (*Parfitt*); Lee Woods, Woolacombe, Ugborough Beacon, and Cawsand (Cosdon) Beacon (*Bracken*). *Dorset:* Near Studland (*Lucas*). *Essex:* Epping Forest (*Shaw*); Clacton-on-Sea (*Harwood*). *Gloucestershire:* (*Edwards*). *Hants:* Southsea, Hayling Island, and St. Catherine's Hill near Christchurch (*Burr*);

New Forest, Need's Ore, and near Christchurch (*Lucas*); Bournemouth (*Kemp-Welch*). *I. of Wight:* Yarmouth (*Lucas*); Afton Down near Freshwater, Blackgang Chine, Parkhurst Forest, Undercliff, and St. Catherine's Point (*Burr*). *Hertfordshire:* Royston (*Harwood*). *Kent:* Near Deal. (*Porritt*); Tunbridge Wells (*Guermonprez*); Bostal (*Shaw*). *Lancashire:* Silverdale and St. Anne's-on-Sea (*Porritt*); Ainsdale (*Coward*); Alithwaite, Birkdale District, Cark in Cartmel, Ellerhow, Grange-over-sands, Hampsfell, Holker Park, Lindeth, Newton-in-Furness (*Sopp*); Lathom and Ormskirk (*Score*); Scarisbrick (*Chaster*). *Lincolnshire:* Mablethorpe (*Porritt*); Brumby Common, Sweetingthorne Wood, Borksey, and Laughterton (*Shaw*); Linwood near Louth, and Manton Common (*Thornley*). *Middlesex:* Acton, 1886 (*Winston*). *I. of Man:* Lonan (*Shaw*). *Norfolk:* Near Waxham, Thursford, Kockham, Syderstone Common, Docking Common (*Shaw*); Yarmouth sand-hills (*Winston*); King's Lynn and Hunstanton (*Atmore*). *Notts:* Edwinstone and Everton (*Thornley*); Sherwood Forest (*Porritt*); Wheatley (*Chamberlin*). *Rutland:* Present according to the Victoria History of the County. *Somerset:* Lundy Island, as *biguttatus* (*Smith*); Combre Florey near Taunton (*Jones*); Batheaston (*Blathwayt*). *Staffordshire:* Dovedale (*Jourdain*). *Suffolk:* Lakenheath Warren, Devil's Ditch, Foxhall, Corton Sand-hills, Southwold, and Lowestoft District (*Morley*); Tuddenham (*Porritt*); Mildenhall (*Perkins*). *Surrey:* Near Weybridge Station, Merrow Downs, Oxshott, Boxhill, Esher Common, and Devil's Punch Bowl at Hindhead (*Lucas*); Frensham and Farnham Commons (*Sopp*); Redhill (*Frisby*); Blindley Heath near Godstone (*Burr*); Wimbledon (*Shaw*); Wisley (*South*); Buckland Hill (*Chapman*). *Sussex:* Ashdown Forest and Forest Row (*Burr*); Beachy Head (*Porritt*); Dallington (*Bloomfield*); Eastbourne (*Sopp*); Heyshott, Cocking, Pagham, and Eartham (*Guermonprez*). *Westmorland:* Arnside and Arnside Knott (*Gamble*). *Yorkshire:* Scunthorpe (*Baysford*); Strensall, and Kirby-moorside (*Hewett*).

Wales.—*Anglesey:* (*Mason*); Llanfaethlu (*Morton*). *Carnarvonshire:* Near Conway (*Porritt*); Mynydd Hill at 700 ft. (*Stowell*). *Glamorganshire:* Gower (Cambridge Univ. Museum). *Merionethshire:* Arthog (*Nevinson*). *Pembrokeshire:* (*Jones*); Newport (*Shaw*).

Scotland.—*G. maculatus* is widely distributed and not uncommon in Scotland, occurring both on the coast and inland: a bare spot on a railway or other bank is, according

to my experience, a favourite habitat (*Evans*). *Aberdeen:* Lumphanan (*Morton*). *Clackmannan:* Castle Campbell, Dollar, and Forest Hill (*Evans*). *Dumbarton*: side of hill road above Peaton, Loch Long (*Evans*). *Dumfries:* Ellangowan (*McGowan*). *Elgin:* Forres (*Chitty*). *Fife:* Aberdour, Pettycur, Thornton, and Falkland (*Evans*). *Haddington:* Saltoun, Dunbar, Aberlady, and Luffness (*Evans*). *Inverness:* Beauly (*Chitty*); Nethy Bridge (*Yerbury*). *Linlithgow:* Craigton, Priestwich, Linlithgow, Cockleroy, Kipps Castle, Cockmuir, and Winchburgh (*Brock*); N. Queensferry (*Evans*). *Midlothian:* Boghall at foot of Pentland Hills, and Ravensneuk Moor near Penicuik (*Evans*). *Nairn:* Nairn (*Yerbury*). *Peebles:* Peebles (*Thornley*). *Perth:* Aberfoyle (*Stewart*); Glen Farg (*Evans*). *Sutherland:* Near Rogart and Lair (*Munro*). *Wigton:* Kirkcowan (*Brock*).

Ireland.—*Cork:* Bear Haven (*fide Kemp*). *Wicklow:* Callary (*fide Kemp*).

Genus 3. **MECOSTETHUS** Fieb.

Mecostethus pt., Fieber Kelch. Orth. Oberschles. p. 1 . . 1852.
Stetheophyma Fisch. Orth. Eur. p. 357 . . . . . 1853.
Stetheophyma Kirby Syn. Cat. Orth. iii. p. 167 . . . . 1910.

Diagnosis.—Vertex produced; foveolæ very small, triangular. Antennæ filiform, in the female about as long as combined head and pronotum, considerably longer in the male. Pronotum with a median carina, and distinct straightish lateral carinæ; cross-furrow at or a little in front of the middle. Elytra well developed in both sexes; sub-costal nervure extending beyond the middle; costal margin arched at the base, where an adventitious nervure is developed; area between medius and cubitus with an intercalary nervure and a double row of cross nervures. Subgenital plate of the male produced to an acute apex. Valves of the ovipositor considerably exserted, the upper pair having some fine crenulations above.

1. **Mecostethus grossus** Linn.

(Plate XX, fig. 4; Pl. XXII.)

grossus	Linn. Syst. Nat. (ed. x). i. p. 433, n. 58	1758—*Locusta Gryllus.*
,,	Linn. Faun. Suec. (ed. ii), p. 239, n. 877	1761—*Gryllus.*
,,	Fieb. Kelch, Orth. Oberschles. p. 1, n. 2	1852—*Mecostethus.*
grossum	Fisch. Orth. Eur. p. 357, n. 1, pl. xvi, f. 3	1853—*Stetheophyma.*
grossus	Fieb. Syn. Eur. Orth. p. 10 . .	1854—*Mecostethus.*
,,	Brunner, Prod. der. Eur. Orth. p. 94, f. 24	1882—*Mecostethus.*
,,	Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 412	1889—*Mecostethus.*
,,	Finot Faune de la Fr. Orth. p. 104, pl. iv, f. 61	1889—*Mecostethus.*
,,	Burr Brit. Orth. p. 33, pl. iii, f. 1	1897—*Mecostethus.*
,,	Lucas Entomologist, p. 169, pl. ii	1899—*Mecostethus.*
Grossum	Kirby Syn. Cat. Orth. iii, p. 167 .	1910—*Stetheophyma.*
grossus	Lucas Proc. S. Lond. Ent. Soc. p. 28, pl. iii, f. 3	1913—*Mecostethus.*

(Other synonyms: *A. rubripes* De Geer; *G. L. germanicus* Stoll; *G. flavipes* Gmel.; *G. flavipes* Steph.)

Unfortunately there has been considerable confusion in the nomenclature of this species. Several specimens are in the British Museum Collection, in the Hope Museum at Oxford, and in the Dublin Natural History Museum, in each case labelled *flavipes*. This is due no doubt to Donovan who gives a good figure of the species ('Nat. Hist. Brit. Ins.' xii. p. 87, tab. 391), but applies to it Gmelin's name *flavipes*. Ridley's Kerry specimen was recorded as *Pachytylus cinerascens* Fabr., which mistake no doubt arose through his finding, either in Fischer's 'Orthoptera Europæa' or in Brunner's 'Prodromus,' *Locusta flavipes* given as a synonym for *Pachytylus cinerascens*, the second error being probably due to the former (*vide* Eland Shaw, 'Ent. Mo. Mag.' 1889, p. 412, and 1893, p. 20).

Original Description.

grossus. 58. G. L. femoribus sanguineis, elytris virescenti-subrufis, antennis cylindricis. *Fn. suec.* 627.
Habitat in Europa.
(C. Linnæus, 'Syst. Nat.' ed. x, tom. i, p. 433, 1758.)

877. GRYLLUS *grossus* femoribus sanguineis, elytris virescenti-subrufis, antennis cylindricis. *Fn.* 627.
Habitat in pratis rarius, ut Bolstavik et alibi in *Roslagia*.
Descr. Est e maximis nostris, et reliquis pallidior et femoribus subtus rubris saturatioribus. *Abdomen* subtus viridi-flavum. *Elytra* flavo-pallida, præsertim antico margine, alias reticulata

uti alæ. *Antennæ* cylindraceæ 24. articulis. *Tibiæ* posticæ nigræ dentibus albis. terminatæ quatuor unguibus præter ungues palmarum. *Femora* postica latere inferiore rubra. *Totus* supra obsolete brunneus seu fusco-lividus. inter pedes anticos acumen thoracis flavescens.

(C. Linnæus, 'Faun. Suec.' p. 239, 1761.)

Male Imago.—In general *colouring* the living insect is bright yellowish-green and brown, with crimson hind femora. *Size* bulky. *Length* 22–32 mm. Expanse of wings 42–55 mm. *Vertex* triangular, the blunt apex being forward; foveolæ indistinct. *Antennæ* fairly long. *Pronotum* somewhat narrowed in front; lateral carinæ nearly straight, median prominent; transverse furrow in front of the middle; hind margin bluntly rounded. *Thorax* pale green ventrally. *Elytra* (Pl. XX, fig. 4) more or less tinged with brown, especially at the apex; a yellow streak along the basal two-thirds of the costal region, in other parts nervures brown. *Wings* brownish at the tip, more or less hyaline elsewhere; anterior nervures brown, hinder ones mostly colourless. Fore and mid *legs* brownish. Femur of hind legs carmine beneath, with an internal black streak, swollen junction of femur and tibia black; tibia yellow, generally with two black rings, spines black. *Abdomen* yellowish ventrally.

Female Imago (Pl. XXII).—*Colouring* similar to that of the male. *Size* larger, sometimes much larger. *Antennæ* not so long in proportion as those of the male. Valves of the *ovipositor* elongate, with several small crenulations above.

Eggs.—Cigar-shaped; very slightly curved in their length; considerably more pointed at one end than at the other; surface slightly granulated; dull ochreous yellow in colour (but colour may not be reliable, as the eggs were not laid but extracted from the dead insect); length about 5·3 mm., greatest diameter about 1·5 mm.

Nymph.—Nymphs may be recognised as such by the undeveloped organs of flight. They are often almost entirely of a beautiful rosy red colour.

Variation.—As far as my own observation goes the species is not subject to much variation except in size, but in this respect the range is certainly very great. I once took a very bright female in the New Forest with rosy dorsal surface of the thorax.

Date.—On 28 July 1919 I took a mature example, and in early years imagines may perhaps be expected by the end of July, but probably they seldom reach that stage till August, which month and the next are the best in which to seek the species.

Habits, etc.—Perhaps the fact that *M. grossus* loves the very wet, and therefore least accessible, parts of bogs and marshes may have been the cause of its having almost escaped notice in the British Isles for so long a time. At Irstead it was taken amongst bog-myrtle and rank grass, but these conditions do not seem to be so much a necessity as a very wet state of the soil. It readily takes to the wing when disturbed and then makes short but rapid flights of about ten or a dozen yards, but it usually will not move unless the sun is shining. One that flew near me had its long legs stretched out behind it, like those of a heron on the wing. When stalked it sometimes rises once or twice, but if thoroughly disturbed hides amongst the rank bog vegetation, with which its colours harmonise so well that it is seldom again found; and for this reason it would seldom be discovered unless it took to the wing. When flying it is so conspicuous an insect that it is certain to be noticed. Though so bulky, on one occasion in the New Forest I came across a male being carried off by the Robber-fly, *Asilus crabroniformis* Linn. The prey was as large as the captor, and probably of a greater weight.

On 4 September 1910 a male and a female captured in the New Forest were kept alive, and taken to Kingston-on-Thames on the 10th. There they were placed in a large fish-globe containing *Sphagnum* and a tuft of grass, the top of the globe being covered with muslin. One was noticed eating the grass, holding

the blade with its fore legs in order to bite along the edge. Its action had a very "human" appearance, like that of a squirrel with a nut. They were seen paired more than once, but I saw no eggs. The male was dead on 18 September, while the female succumbed about the 26th, the latter having eaten much grass a few days before. When handled *M. grossus* emits a dark brown-green fluid from its mouth.

Distribution.—This grasshopper is found in Europe and Siberia, its range in the former extending from Lapland to the Alps. It has been recorded from Lapland, Holland, Belgium, England, Ireland, France, Austria, and the north of Spain and Portugal.

British Distribution and History.

In 1889 Eland Shaw wrote:—"*M. grossus* is distributed widely over Northern Europe and in Spain in marshy localities, and will, I expect, be found fairly plentiful in our fen districts when properly looked for" ('Ent. Mo. Mag.' 1889, p. 413). Captures in recent years show that this prophecy has to a great extent been fulfilled, if in the term "fen" we may include "bogs," such as those which occur so commonly in the New Forest.

At the date above mentioned Shaw knew of but two modern captures of this species; one specimen taken by McLachlan in the fens of Norfolk, and one by H. N. Ridley between Glencar and Waterville in Co. Kerry, the latter being recorded in the 'Ent. Mo. Mag.' vol. xx, p. 215, as *Pachytylus cinerascens*. Previous to 1889, however, J. C. Dale took the species at Whittlesea Mere, Parley Heath, and in the New Forest; while C. W. Dale recorded it as occurring on the Dorset heaths and in the Isle of Purbeck, the last specimens he took in the latter locality being captured on 27 July 1880. C. W. Dale says further that it "has occurred in the west of Ireland, and in the counties of Dorsetshire, Hampshire, Huntingdonshire, Cambridgeshire, and Norfolk; and in former years in the marshes close to London" ('Entom.' 1895, p. 333). Bardulph Fen is one of the actual localities referred to.

On 10 September 1892 one male was taken at Irstead in Norfolk (Shaw) amongst tall rank grass close to the bank of the River Bure, this being the first recorded capture of the species in Britain since the taking of the Kerry specimen,

which was recorded by Ridley in January 1884. In July 1895 it occurred in abundance in the West of Ireland, as recorded in the 'Irish Naturalist,' vol. iv, pp. 228 and 258, by M. G. H. Carpenter; while in September of the same year B. G. Rye took the species in Norfolk in some numbers by sweeping the bog-myrtle (*Myrica gale*). The next year W. Jeffreys took several in a bog a few miles from Lyndhurst in the New Forest; and he found it also in another spot on the same side of the Forest (*in litt.* 1897). In the beginning of August 1898 J. J. F. X. King and myself found the species fairly common in two bogs on the other side of the Forest. In that season, which was a rather late one, it commenced to appear in the imaginal form just about the beginning of August. As the days went on it seemed to increase in numbers, but nymphs were still taken. Since 1898 the species has rewarded my search in a number of parts of the Forest, and it may safely be said that it is plentiful in that district, occurring in most bogs that are not quite small. Perhaps Paget's "*Locusta flavipes* Belton Bog, common," is this species (*fide Morley*). F. Balfour-Browne reports it for Norfolk in Sutton and Barton Parishes as well as in Catford, in September, all the places being in the Ant valley: J. Edwards reports it for Horning, and F. H. Haines from Morden in Dorset.

S. W. Kemp found, in the Trinity Coll. Collection in Dublin, specimens from Oughtered and Recess (Co. Galway) and from Killarney (Co. Kerry), and two specimens in Haliday's Collection probably from Kerry or Galway. Another locality is Foxford, Co. Mayo (British Museum).

C. Stewart in a "List of Insects found in the neighbourhood of Edinburgh," 1809, gives *Gryllus grossus*; and in G. Don's 'Account of the Plants and Animals of the County of Forfar,' 1813, *Gryllus grossus* also occurs. These records, however, are not sufficient to warrant our claiming it as a Scotch insect though there is no reason why it should not occur on bogs in the west.

Genus 4. **STENOBOTHRUS** Fisch.

Stenobothrus Fisch. Orth. Eur. pp. 296, 313 . . . . 1853.

In the wide sense *Stenobothrus* may be diagnosed as follows: *Foveolæ* of vertex narrow, somewhat oblong in shape. *Antennæ* filiform. *Pronotum* with one cross-furrow; median carina distinct, lateral ones straight

or more or less incurved. *Elytra* fully developed (rarely abortive); costal area more or less extended, either narrow throughout or dilated at the base. No intercalary nervure. *Wings* fully developed (rarely abortive or wanting). First segment of the *abdomen* with a closed tympanum; subgenital plate in the male recurved. Valves of the *ovipositor* short, but exserted, sometimes bearing a lateral basal tooth.

Stenobothrus, in this sense, was an unwieldy genus; Bolivar therefore split it up into four as follows, one being *Stenobothrus* in a restricted sense :—

1. Costal area of elytra gradually narrowed towards the apex, prolonged along the costal margin, and not dilated with a lobe at the base, so that the costal margin is straight.
   2. Valves of the ovipositor armed with a strong tooth on the outer side, pointing in the same direction as the points of the valves . . . *Stenobothrus* Fischer.
   2.2. Valves of the ovipositor with no lateral tooth . . . *Omocestus* Bolivar.

1.1. Costal area of elytra rapidly narrowing towards the apex, generally not exceeding half the length of the elytra, broadest near the base so as to form a lobe or dilatation, so that the costal margin is not straight, but convex near the base.
   2. Lateral carinæ of pronotum bent in at an angle or curved in the prozona, diverging posteriorly . . . . *Stauroderus* Bolivar.
   2.2. Lateral carinæ of pronotum straight and parallel or only very slightly curved in the prozona . . . . *Chorthippus* Fieber.

('Cat. Sinóp. Orth. Fn. Ibérica,' pp. 45, 46, 1900.)

1. **Stenobothrus lineatus** Panzer.

(Plate XIX, fig. 3; Pl. XX, fig. 1; Pl. XXIII, fig. 8.)

lineatus	Panz. Faun. Ins. Germ. fasc. xxxiii, f. 9	1796—*Gryllus.*
,,	Fisch. Orth. Eur. p. 325, n. 9, pl. xvii, f. 1	1853—*Stenobothrus.*
,,	Brunner Prod. der. Eur. Orth. p. 104	1882—*Stenobothrus.*
,,	Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 414	1889—*Stenobothrus.*
,,	Finot Faune de la Fr. Orth. pp. 109, 111, pl. v, ff. 68, 69	1889—*Stenobothrus.*
,,	Burr Brit. Orth. p. 35, pl. iii, f. 2 .	1897—*Stenobothrus.*
,,	Burr Syn. Orth. W. Eur. p. 33 . .	1910—*Stenobothrus.*
Lineatus	Kirby Syn. Cat. Orth. iii, p. 162 .	1910—*Stenobothrus.*
lineatus	Lucas Proc. S. Lond. Ent. Soc. p. 29, pl. iii, f. 2	1913—*Stenobothrus.*

(Other synonyms:—*G.* (*L.*) *tenellus* Stoll; *A. megacephalum* Seidl.)

Original Description.

GRYLLUS LINEATUS.

Die gestrichelte Grylle.

Gryllus lineatus: thorace carinato viridis, elytris apice lineola oblique alba.

Caput viride. Os flavum. Antennae flavae apice fuscae. Thorax carinatus margine laterali utrinque linea elevata rosea. Elytra viridia apice fusca, striga reticulata oblique alba. Corpus fuscum. Femora postice clavata supra viridia.

Habitat in Germaniae campis arenosis.

(G. W. F. Panzer, 'Fauna ins. Germ.' fasc. xxxiii, 1796.)

[There is a fairly good coloured figure.]

Male Imago.—Much green in the general *colouring*; but it is relieved by various markings, which give a pleasing appearance. *Length* some 14–15 mm. *Head* large, green. *Vertex* roundly produced a little between the eyes; foveolæ practically absent, as is also the median sulcus of the frons. *Pronotum* dark green, rounded behind; cross furrow at about the middle; lateral carinæ slightly angled in the middle of the prozona, pale and often tinged with rosy, interrupting two longitudinal black lines. *Elytra* (Pl. XX, fig. 1) pale brown, with a crescent-shaped white spot surrounded by a brown ring; anal area green; the wide area between the medius and cubitus crossed by closely set parallel nervures; costal area long; elytra longer than the abdomen. *Wings* smoky at the tip. Hind

femora sometimes green above, otherwise *legs* brown. Tip of *abdomen* reddish in this sex.

Female Imago (Pl. XXIII, fig. 8).—*Colouring* in general as in male. Size much bulkier; length some 19–23 mm. *Antennæ* shorter than in the male. *Elytra* about as long as the abdomen ; a whitish streak between the two branches of the sub-costa. *Ovipositor* (fig. 25) heavy-looking, all the valves having an external tooth.

Date.—It is sometimes mature by the end of July ; but August and September are the best months for the

Fig. 25.—Ovipositor of *Stenobothrus lineatus* Panzer. Side view, much magnified.

species in the imaginal condition. It continues, however, into October. The nymph stage may continue for a long time ; one taken on October 18th became an imago in captivity on October 21st.

Habits.—Personally I have not had very much experience of the species in natural conditions. Shaw says its habitat is dry meadows. I know it only from cliff sides, and the southern slope of the North Downs. In the latter locality it appears to flourish.

Distribution.—Europe except in the extreme north (Burr) ; Siberia (Kirby). It is reported from England, France, Spain, Switzerland, Belgium, and Sweden at least.

British Localities.

All of the records, which are not at all numerous, are from England, most of them being in the south, frequently near the sea.

England.—*Berks:* Reported from near Radley College (*Burr*). *Devon:* A rarity (*Bracken*); Wembury Cliffs (*Bignell*); Braunton Burrows (*Parfitt*). *Dorset:* Between Lulworth and Weymouth, and near Studland (*Lucas*). *Gloucestershire:* Colesbourne (*Edwards*). *Hampshire:* Bournemouth (*Winston*); New Forest (*Burr* mentions it, but I have not met with it there). *Kent:* Folkestone (*Briggs*); Dover (*Porritt*); Charing (*Chitty*); Stonehall, and near Sibertswold (*Burr*). *Norfolk:* Docking Common (*Shaw*). *Surrey:* Boxhill (*Briggs*); Leatherhead (*Burr*); Redhill (*Frisby*); Merrow Downs, and between Denbies and Pickett's Hole (*Lucas*); Buckland and Dorking (*Chapman*). Dr. Chapman on investigating the habitat of this grasshopper on the southern slope of the North Downs found examples in suitable spots from Reigate to Pickett's Hole, sometimes quite commonly. A Buckland locality, where he knew them to be present previously, but where they are scarce, is part of the same slope of the North Downs several miles to the east. Probably a stricter search would extend the known range of the species in this district. *Sussex:* Selsea, Cocking Down, and Goodwood (*Guermonprez*).

2. St. (Omocestus) rufipes Zett.

(Plate XIX, fig. 5; Pl. XX, fig. 5; Pl. XXIII, fig. 6.)

rufipes	Zett. Orth. Suec. p. 90, n. 9, ♂ .	1821—*Gryllus.*
ventralis	Zett. Orth. Suec. p. 89, n. 8, ♀ .	1821—*Gryllus.*
rufipes	Fisch. Orth. Eur. p. 331, n. 12 *a*, pl. xvi, f. 16	1853—*Stenobothrus.*
,,	Brunner Prod. der Eur. Orth. p. 113	1882—*Stenobothrus.*
,,	Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 416	1889—*Stenobothrus.*
,,	Finot Faune de la Fr. Orth. pp. 109, 116, pl. v, ff. 77, 78	1889—*Stenobothrus.*
,,	Burr Brit. Orth. p. 36, pl. iii. f. 4 .	1897—*Stenobothrus.*
,,	Burr Syn. Orth. W. Eur. p. 38 .	1910—*Omocestus.*
Ventralis	Kirby Syn. Cat. Orth. iii. p. 174 .	1910—*Omocestus.*
rufipes	Lucas Proc. S. Lond. Ent. Soc. p. 30, pl. iii, f. 4	1913—*Omocestus.*

(Other synonyms: *O. viridulum* Wesm.; *C. Zetterstedtii* Fieb.; *A. abdominale* Herr.-Schaff.; *Œ. cruentata* Brullé; *Œ. geniculata* Brullé; *L. miniata* Steph.)

Original Description.

9. G. rufipes, thorace tricarinato, carinis lateralibus curvatis; fuscus, thoracis vitta media longitudinali hemelytrorumque dorso,

testaceis; pedibus glabris, posticis, ventre anoque, sanguineis (♂).

Hab. in pratis aridis ad Lärketorp Ostogothiae & ad Björnstorp Scaniae, a die 6 Aug. usque ad diem 14 Sept. visus, varius. Stridentem non audivi, at mores de cetero *G. viridulī*. Larvas hujus speciei 15 Aug. deprehendi.

Descr. 1, v. *Mas*. Statura corporis *G. viridulī*, sed duplo minor, mari *G. paralleli* aequalis. *Caput* forma vulgari, fusco-brunneum, palpis testaceis. *Frons* magis decliva, quam in *G. viridulo*. *Oculi* ovati, brunnei, in exsiccatis saepe glauci. *Antennae* thorace fere dimidio longiores, obscurae, basi plerumque pallidae. *Thorax* ut in priori constructus, at dorso antice adhuc angustiori, quam in illo; fuscus, vitta media longitudinali plerumque testacea, interdum brunnea, & linea utrinque, carinis lateralibus abrupta, atra. *Hemelytra* longitudine apicem femorum posticorum attingunt, at abdomine (circiter 2 lin.) longiora, dorso pallida, margine exteriori late apiceque, nigris; lineola versus apicem alba, in plerisque distincta. *Alae* fuscae. *Abdomen* nigricans, ventre anoque sanguineis. *Pedes* glabri, fusco-testacei, postici sanguinei, genubus, tibiarum summo apice spinisque nigricantibus. *Pulvilli* determinati, fusci.

Obs. Color vivorum in exsiccatis bene conservatur. Variat, sero auctumno, totus obscurior, pedibus posticis testaceis.

(Zetterstedt, 'Orthoptera Sueciae,' p. 90, 1821.)

[Zetterstedt described the female and the male as two species; the former, which he names *G. ventralis*, is no. 8, while the latter, *G. rufipes*, is no. 9. The name of the male has been almost universally employed, and to introduce confusion by adopting now Zetterstedt's name for the female would be, to say the least, pedantic. For the sake of those interested, however, his description of that sex is appended.

8. G. ventralis thorace tricarinato, carinis lateralibus curvatis; niger, verticis thoracisque linea longitudinali hemelytrorumque dorso, viridibus; pedibus glabris, posticorum tibiis basi annulo albo; ventre sanguineo (♀).

Hab. in prato ad Esperöd in Paroecia Tranås Scaniae, mens. Septemb. rarissime.

Descr. 1. v. *Fem*. Affinis praecedenti [*Gryllus viridulus*], at ejus individuum masculum magnitudine vix attingit, &, me judice, distinctus. Differt ab illo, praeter colorem determinate alium, antennis pedibusque anticis paullo brevioribus & thoracis carinis lateralibus paullo magis curvatis, unde hujus dorsum antice angustius videtur. *Caput* nigro-fuscum, palporum apice pallido. *Vertex* ut in priori constructus, viridis, linea utrinque nigra. *Frons* quoque ut in praecedente, at minus forte convexa. *Oculi* ovati, subdepressi, brunnei. *Antennae* thorace paullo brevories, 22-articulatae ? testaceae, apice nigro. *Thorax* latitudine fere duplo longior, anterius angustatus, antice truncatus, lobo-laterali deflexo subangulato, postice rotundatus, marginatus, supra tricarinatus, carinis lateralibus antice distincte curvatis, non autem angulatis; niger, dorso viridi, & carinis pallidis, linea quoque ordinaria, atra, carinis lateralibus abrupta, utrinque adest. *Hemelytra* longitudine apicem femorum posticorum attingunt, dorso viridia, margine exteriori apiceque late nigris, & lineola obliqua versus apicem distinctiori alba. *Alae* nigricantes. *Abdomen* nigrum, nitidum, ventre sanguineo. *Pedes*

forma vulgari, glabri, nigri, anteriores picei, posticorum femoribus subtus flavis tibiisque annulo ad basin albo. (Zett. 'Orth. Suec.' p. 89. 1821.)]

Male Imago (Pl. XXIII, fig. 6).—General *colour* dark brown with a ruddy tint in places. Small. *Length* 12–13 mm. Apex of *palpi* strikingly pale, against the dark jaws. *Vertex* produced in a triangle between the eyes; foveolæ oblong, rather shallow but well marked, median sulcus of frons moderately deep below the ocellus. *Pronotum* with cross furrow very nearly in the centre, but perhaps a little nearer the front; a black interrupted streak on each side; lateral carinæ angled about the middle of the prozona; in front of the angle carinæ nearly parallel; hind margin rather angled than rounded. *Elytra* (Pl. XX, fig. 5) longer than abdomen; pale brown, somewhat spotted; region between medius and cubitus narrow, cross nervures sub-regular. *Wings* smoky towards the tip. *Legs* somewhat ruddy. *Abdomen* dark, yellow below, bright ruddy at the apex.

Female Imago (Pl. XXIII, fig. 6).—*Colour* similar to that of the male, except that the mid-dorsal region is usually green, causing this sex to closely resemble that of *O. viridulus;* but the *palpi* are very distinctive. *Bulk* much more considerable than that of the male. *Length* 18–19 mm. *Antennæ* rather shorter than in the male. *Elytra* as long as, or longer than, the abdomen; anal area green. *Abdomen* and *legs* not so brightly coloured as in the male. Valves of the *ovipositor* without an external tooth, lower ones with inner margin produced into a rather sharp point.

Distinction from *O. viridulus*.—(1) The darker colour of *O. rufipes*. (2) The distinctly pale palpi. (3) The elytra spotted in the area between media and cubitus. (4) The brightly ruddy abdomen.

Sometimes *S. bicolor* has a reddish apex to the abdomen in the male, so the structure should be examined with the table of genera on page 231 to

prevent mistakes. In *O. rufipes* the angle of the lateral carinæ of the pronotum is less sharply curved than in *S. bicolor*.

Date.—July, August, and September are the best months for the imago; but it may possibly be mature in June. I have met with nymphs on 11 August in the New Forest.

Habits, etc.—Personally I have had experience of this species only in the New Forest. There it seems to like open healthy or dry ground, especially just outside a wood or plantation, or in a ride or clearing. In captivity it fed on grass, eating along the margin of a leaf. One was thus kept alive for six or seven weeks, dying on or about 14 October.

Distribution.—This species is considered to be generally distributed over Europe from Sweden to the Mediterranean, its range being similar to that of *O. viridulus*, but it is less frequent in the north, and does not reach so great an altitude as its congener. It is recorded from England, France, Scandinavia, Holland, Belgium, Spain, Portugal, and Italy at least. It is also found in Algeria, Asia Minor, and Siberia.

British Localities.

England.—*Berks:* Neighbourhood of Radley College (*Burr*). *Cambridgeshire:* Wicken (*Porritt*). *Devon:* On the coast, not common (*Bignell*); Lynton (*Briggs*); Churston (*Porritt*); Woollacombe (*Bracken*). *Gloucestershire:* Wotton (*Shaw*). *Hants:* New Forest in many places (*Lucas*); Bournemouth (*Burr*). *Kent:* Deal (*Briggs*); Herne Bay (*Waterhouse*, exhibited at Ent. Soc. Lond. 7 Sept. 1887); Bromley (*Shaw*). *Lake District:* (*Porritt*). *Somerset:* Batheaston (*Blathwayt*). *Suffolk:* "Broad," apparently near Barnby, and two doubtful records—Beccles and Ipswich District (*Morley*). *Surrey:* Leith Hill (*Briggs*); Boxhill (*Burr*). *Sussex:* Abbot's Wood (*Porritt*); Guestling, some years ago (*Bloomfield*). *Yorkshire:* Thorne Moor, Sandburn, Castle Howard, and near York (*Porritt*); Strensall Common (*fide Sopp*).

Wales.—*Carnarvonshire:* Penmaenmawr (*Porritt*).

(Burr says it has been recorded from Rannoch in Scotland: he thinks C. W. Dale was his authority.)

3. St. (Omocestus) viridulus Linn.

(Plate XIX, fig. 6; Pl. XX, fig. 6; Pl. XXIV.)

viridulus Linn. Syst. Nat. (ed. x) i, p. 433, n. 55 . . . . . 1758—*Gryllus Locusta.*
„ Linn. Faun. Suec. (ed. ii), p. 238, n. 874 . . . . . 1761—*Gryllus.*
„ Fisch. Orth. Eur. p. 329, n. 12, pl. xvi, f. 15 . . . . . 1853—*Stenobothrus.*
„ Brunner Prod. der Eur. Orth. p. 111, f. 28 e . . . . . 1882—*Stenobothrus.*
„ Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 415 . . . . 1889—*Stenobothrus.*
„ Finot Faune de la Fr. Orth. pp. 109, 116, pl. v, ff. 75, 76 . . 1889—*Stenobothrus.*
„ Burr Brit. Orth. p. 35, pl. iii, f. 3 1897—*Stenobothrus.*
„ Burr Syn. Orth. W. Eur. p. 39 . 1910—*Omocestus.*
Viridulus Kirby Syn. Cat. Orth. iii, p. 175 . 1910—*Omocestus.*
viridulus Lucas Proc. S. Lond. Ent. Soc. p. 30, pl. iii, f. 1 . . . . . 1913—*Omocestus.*

(Other synonyms:—*G. rubicundus* Gmel.; *L. aprica* Steph.; *A. rufomarginatum* De Geer; *A. nigroterminatum*, De Geer; *G. dimidiatus*, Thunb.; *G. marginalis* Thunb.)

Type of genus *Omocestus.*

Original Description.

viridulus. 55. G. L. thorace cruciato, corpore supra viridi, elytrorum margine albido. *Fn. svec.* 626.
It. wgoth. 276. Gryllus capite thorace elytrisque superne viridibus.
Habitat in Europa.
(C. Linnæus, 'Syst. Nat.' ed. x, Tom. i, p. 433, 1758.)

874. GRYLLUS *viridulus* thorace cruciato, corpore supra viridi, elytrorum margine albido. *Fn.* 616.
Habitat copiosissime omnium ad *Bursviken* juxta mare, ubi instar sementantis segetis ante pedes cadit.
Descr. Hic inter minimos (si non minimus omnium) nostros numerandus est. *Corpus* superne viride, quum caput et thorax supra saturate viridia. *Alæ* dilute virides, exteriores sive elytra viridia margine exteriore seu lateri albo. Abdomen, pectus, femora, facies pallida. *Antennæ* articulis xxiii circiter constant.
Variat in quibusdam angulo utrinque thoracis dorsali lineola alba et alia lineola alba inter marginem elytrorum album et discam alæ.
(C. Linnæus, 'Faun. Suec.' p. 238, 1761.)

Male Imago (Pl. XXIV, fig. 1).—*Colour* usually ruddy brown and green; sometimes the mid-dorsal region green, which gives a green appearance to the whole insect. *Length* 14–15 mm. Apex of *palpi* concolorous

with the jaws. *Vertex* produced as in *O. rufipes*, with a central carina at the tip. *Foveolæ* of the vertex as in *O. rufipes*. Median *sulcus* of the frons moderately pronounced below the conspicuous median ocellus. Cross furrow of the *pronotum* slightly nearer the front margin; two longitudinal black streaks, interrupted by the lateral carinæ (usually pale), which are slightly angled near the front margin of the pronotum. *Elytra* (Pl. XX, fig. 6) longer than abdomen, pale brown, sometimes with anal area greenish; less spotted than in *O. rufipes*; region between medius and cubitus narrow, with subregular cross nervures. *Wings* smoky at the apex. *Hind femora* usually brown.

Female Imago (Pl. XXIV, fig. 2).—*Colour* more green than that of the male; *hind femora* often green. Much more bulky than the male. *Length* 18–23 mm. *Antennæ* slightly shorter than those of the male. *Elytra* about as long as abdomen or longer; anal area green; usually a dull yellowish or pinkish streak between the subcostal nervures. Valves of the *oripositor* without an external tooth; inner edge of lower ones produced into a rather sharp point.

Variation.—There is a form of the female with sides of head and pronotum, all the legs, and the fore part of the elytra of a deep rosy red. Eland Shaw has specimens of this form from Yarmouth (Winston) and Louth (Wallis-Kew). It is perhaps Stephens's *rubicunda*. On 14 August 1917 I took a female in the New Forest somewhat resembling this form. There was very much deep dull crimson in its colouring. Even when seen on the grass it was so strikingly coloured as to catch the attention immediately. The antennæ were tinged with crimson towards the base; the dorsal surface was green generally as usual, except for a median crimson line on head and thorax; face, sides of head and thorax, and dorsal surface of the femora of all the legs were crimson; costal region of the elytra dull crimson. Shaw speaks of an example with yellow femora. On

the whole, however, I have not found *O. viridulus* subject to much variation.

Date.—This species is usually mature soon after the middle of June, and it may be found from that time till well into September, if not later. It is in fact one of the earliest of our grasshoppers to reach the mature condition.

Habits, etc.—Possibly there may be some connection between the green colouring of *O. viridulus* and its apparent preference for grassy places. On the whole perhaps it affects slightly elevated grass lands, moors, and similar places more frequently than low lying spots, though Morley records it from marshes at Beccles. In captivity it will eat grass, holding a blade with its fore legs, so as to eat along the margin, as noticed of other British Acridians. The following curious occurrence may be worthy of note. On 1 August 1910 at a damp spot in a "ride" in the New Forest, where grass was luxuriant, a number of grasshoppers were found dead, but holding to the grass as if simply resting there. Perhaps all were *O. viridulus*. In some cases the abdomen seemed unduly distended, but there was no obvious cause of death.* Was the luxuriant grass too succulent for them?

Distribution.—*O. viridulus* is widely distributed in northern and central Europe, and is found in Siberia and Amur.

British Localities.

O. viridulus is one of our common grasshoppers, being found in all four divisions of the United Kingdom.

England.—*Berks:* Neighbourhood of Radley College (*Burr*). *Bucks:* East Burnham Common, and Burnham Beeches (*Campion*). *Cambridgeshire:* Wicken (*Porritt*). *Cheshire:* Delamere, Great Meols, and Hoylake (*Sopp*); Frodsham (*Warrington Municipal Museum*). *Cornwall:* Cloggy Moor (*Daws*); Perranporth (*Bracken*). *Cumberland:* Salkeld

* A female *Gomphocerus maculatus* was found in a similar condition in the New Forest on 19 August 1918.

(*Day*). *Derbyshire:* Dovedale (*Jourdain*); Kirk Ireton (*Abell*); common in Burton District (*Brown*); Little Eaton (*Pullen*). *Devon:* Common everywhere (*Bignell*), but Bracken does not find it so; it is not so common as *S. bicolor* (*Bracken*); Lynn Valley (*Briggs*); Dartmoor (*Shaw*); Cawsand (Cosdon) Beacon, Woolacombe, Cliffs at Plymouth Sound (*Bracken*). *Essex:* Epping Forest (*Shaw*). *Hants:* New Forest, and Hengistbury Head (*Lucas*). *I. of Wight:* Yarmouth (*Lucas*); Parkhurst Forest (*Burr*); Haven Street Woods (*Morley*); Newport (*Morey*). *Herefordshire:* Near Downton (*Stowell*). *Kent:* Ham Ponds, Sandwich Bay, Golgotha, Stonehall, Chalksole, Ewell Minnis, and Folkestone Warren (*Burr*). *Lancashire:* Alithwaite, Birkdale, Cark-in-Cartmel, Freshfield, Grange-over-Sands, Hampsfell, Holker, and Silverdale (*Sopp*); Lathom and Ormskirk (*Score*). *Lincolnshire:* Brumby Common, Cabourne, Pillar Woods, and Burringham (*Shaw*); Scotton Common and Manton Common (*Thornley*); Mumby Chapel (*Mason*); Louth (*Wallis-Kew*). *Middlesex:* Hadley Wood, 1892 (*Shaw*); Acton, 1885 (*Winston*). *I. of Man:* Douglas (*Porritt*); Laxey (*Shaw*); Ballaugh (*Cassal*). *Norfolk:* Docking Common, Sculthorpe Moor, Thursford, Fakenham, and The Staith, Hickling Broad (*Shaw*); Yarmouth (*Winston*); Surlingham Broad (*Morley*). *Notts:* Edwinstowe and Oberton (*Shaw*); Kingston-on-Soar (*Thornley*); Worksop (*Houghton*); Mansfield (*Daws*). *Somerset:* Combre Florey near Taunton (*Jones*); Batheaston (*Blathwayt*). *Staffordshire:* Ellastone (*Jourdain*). *Suffolk:* Beccles, Barnby Broad, Southwold, Tuddenham Fen, and Lowestoft District (*Morley*). *Surrey:* Esher Common, Horsley, Oxshott, Byfleet Canal, Bookham Common, Prince's Coverts, Wimbledon Common, Netley Heath, and Boxhill (*Lucas*); Leith Hill (*Briggs*). *Sussex:* Forest Row, Ashdown Forest, and East Grinstead (*Burr*); "Long Meadow" (*Porritt*); Ewhurst (*Bloomfield*); Beachy Head (*Stevens*); Cocking and Goodwood (*Guermonprez*). *Warwickshire:* Coventry (*Whittaker*). *Westmorland:* Arnside and Arnside Knott (*Gamble*). *Wilts:* Marlborough District (*Stowell*). *Yorks:* Huddersfield, Bradford, Castle Howard, Hayburn Wyke, Thorne, and Landburn (*Porritt*); Grassington (*Hartley*); Caterick (*Chitty*); Strensall Common and Speeton (*Hewett*).

WALES.—*Anglesey:* (*Mason*). *Carnarvonshire:* Mynydd Hill (*Stowell*). *Flintshire:* Mannerch (*Meek*). *Merionethshire:* Arthog (*Nevinson*). *Pembrokeshire:* (*Jones*).

SCOTLAND.—This grasshopper is common in Scotland, more especially in hilly or inland districts: it doubtless occurs all

over the country, being adult chiefly in August and September. Records are as follows: *Aberdeenshire:* Lumphanan (*Morton*). *Argyle:* South end of Mull of Kintyre (*Stewart*). *Berwickshire:* Carfrae Common, Lammermuirs (*Evans*). *Dumfries:* Ellangowan District (*McGowan*). *Fifeshire:* Thornton, Tentsmuir, Aberdour, and Falkland (*Evans*). *Haddingtonshire:* Tyninghame, and east bank of Dean Burn above Pogbie (*Evans*). *Inverness-shire:* Beauly near Inverness (*Chitty*); Nethy Bridge (*Yerbury*); Upper Glen Spean (*Evans*). *Lanarkshire:* Carluke (*Morton*); Elvanfoot (*Evans*). *Linlithgowshire:* common and generally distributed in suitable localities; Drumshoreland, Craigton, Riccarton Hills, and Kirkliston, also Linlithgow and Bathgate Hills, up to 800 ft. (*Brock*). Brock notes that from *highly cultivated* ground near Kirkliston it had disappeared before 1912. *Mid Lothian:* Braid and Blackford Hills, Pentland Hills at Boghall and Glencorse, Kirknewton, and west bank of Dean Burn below Soutra Hill (*Evans*). *Perthshire:* Aberfoyle and Blair Athol (*Evans*). *Renfrewshire:* Kilbarchan (*Stewart*). *Stirlingshire:* Ben Lomond (*Shaw*); Craigbarnet, Campsie (*Evans*). *Wigtonshire:* Killantringan (*Evans*); Kirkcowan (*Brock*).

Ireland.—*Armagh:* Lough Gill. *Cork:* Adrigole. *Donegal:* Coolmore and McDara Isles. *Dublin:* Chapelizod. *Fermanagh:* Beleck. *Galway:* Oughterard. *Kerry:* Killarney. *Louth:* Castle Bellingham and Dundalk. *Meath:* Drogheda and Mentrim. *Westmeath.* *Wicklow:* Bray and Glandalough—(all *fide Kemp*). Shaw also records the species from Howth (co. Dublin) and from co. Limerick, and Morton from Emyvale (co. Monaghan).

4. St. (Stauroderus) bicolor Charp.

(Plate XIX, fig. 4; Pl. XX, fig. 7; Pl. XXV.)

bicolor	Charp. Hor. Ent. p. 161 . . .	1825—*Gryllus.*
,,	Bris. Ann. Soc. Ent. Fr. (3) iv, p. 748, note	1856—*Stenobothrus.*
,,	Brunner Prod. der Eur. Orth. p. 120, f. 28g	1882—*Stenobothrus.*
,,	Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 417, ff. 3, 4, 5	1889—*Stenobothrus.*
,,	Finot Faune de la Fr. Orth. pp. 110, 122, pl. vi, f. 83	1889—*Stenobothrus.*
,,	Burr Brit. Orth. p. 37, pl. iii, f. 5 .	1897—*Stenobothrus.*
,,	Burr Syn. Orth. W. Eur. p. 44 . .	1910—*Stauroderus.*

Bicolor KIRBY Syn. Cat. Orth. iii, p. 181 . . 1910—*Stauroderus.*
bicolor LUCAS Proc. S. Lond. Ent. Soc. p. 30, pl. iii, f. 5 . . . . . 1913—*Stauroderus.*

(Other synonyms: *G. mollis* Charp.; *L. mollis* Steph.; *L. biguttula* Steph.; *L. vittata* Steph.; *L. hæmorrhoidalis* Steph.; *L. rhomboidea* Steph.; *L. varipes* Steph.; *L. venosa* Steph.)

ORIGINAL DESCRIPTION.

Gryllus bicolor.

Gr. thorace cruciato, corporis lateribus pedibusque ferrugineo-luteis, fusco subirroratis: elytris et superiore corporis parte atris.

Schaeff. Icon. Tab. 243, fig. 5, 6, foem.

Habitat in Silesia, Helvetia.

Gr. biguttulo affinis; foemina mare plerumque quinta parte major, interdum aequalis. Colore luteo vel luride aurantio laterum pedumque et colore atro verticis, thoracis dorsi elytrorumque facile dignosci potest.

Caput maris valde, foeminae minus declive, luteum, vertice atro. Antennae ut in congeneribus, fuscae, basi lutescentes.

Thorax tetragonus, linea dorsali elevata recta et duabus lateralibus paullum angulato-curvatis: luteus, supra ater.

Abdomen supra fuscum, postice rutilum: infra virescens: in mare coloribus vivacioribus, quam in foemina.

Elytra oblonga, attenuata: in mare pauxillulum antica parte dilatata, forma fere Gr. viriduli; fuliginosa, nervis fuscioribus; loculo lucidiore apicem versus, ubi in aliis speciebus affinibus macula obliqua alba posita est. Interdum adsunt maculae plures parvae fuscae, praecipue in maribus.

Alae pellucidae, nervis fuscis, ad apicem et marginem anticum fusciioribus.

Pedes omnes lutei, fusco-punctati. Femorum posticorum latera externa disco fusco: latera interna fusco-variegata: inferiora flavida. Tibiae posticae rufescentes vel virescentes, geniculis vix obscurioribus.

Mares magnitudine paullulo ampliore et elytris attenuatis a maribus Gr. biguttuli et Gr. mollis optime distinguuntur.

Diversam hanc esse quidem et non varietatem Gr. biguttuli credo, cui in multis quidem partibus persimilis est. Mas, uti jam dixi, tota elytrorum forma ab illo recedit, et de colore viridi vel rubro, in Gr. biguttuli foeminis occurrente, nunquam quidquam in Gr. bicolori observavi.

Magis in agris, quam in pratis et collibus habitare videtur.

(Charpentier, 'Horae Entomologicae,' p. 161, 1825.)

MALE IMAGO (Pl. XXV, fig. 2).—*Colour* very variable, usually some tint of brown more or less variegated; somewhat hairy, especially when newly adult. *Length* some 13 mm. *Antennæ* rather long. *Verteæ* produced in a somewhat triangular point; *foveolæ* oblong, well marked; median *sulcus* of the frons long, pronounced. Cross furrow of the *pronotum* rather nearer the fore margin; lateral carinæ sharply angled about the middle of the prozona; interrupted dark longitudinal

lines sometimes present. *Elytra* (Pl. XX, fig. 7), longer than the abdomen; costa arched near the base; some shade of brown; usually spotted. *Wings* hyaline, but sometimes smoky just at the tip. *Legs* of various tints, usually variegated, sometimes ringed. Apex of *abdomen* sometimes red.

Female Imago (Pl. XXV, fig. 1).—*Colour* and length of the *antennæ* much as in the male. *Size* much larger; *length* some 22 mm. *Elytra* reaching beyond the apex of the abdomen; sometimes a pale streak between the subcostals. *Oripositor* short, valves rather blunt, without an external tooth.

Variation.—Extremely variable in colour—scarcely two being exactly alike. The general colouring may be green, red, purplish-yellow, grey, brown, almost black, and sometimes variegated. Whenever the surroundings are sufficiently definite, the colour assimilates, sometimes most accurately, with them. Porritt records an interesting case of this kind. "St. Anne's-on-Sea is a modern seaside resort built upon the sandhills of the Lancashire coast. On the outskirts of the town there are often small sandy spaces left between the houses, and in some of these ashes and other rubbish from the houses have been thrown, the consequence being that the sand has become of dirtier and darker appearance. In such situations *S. bicolor* still flourishes, but there is a very perceptible difference in the colour of the specimens as compared with the ordinary forms, the tendency to become darker being so marked that some of them are already absolutely black. On the open sandhills the colours of the species, though variable as usual, are quite normal." Hamm noticed that a common grasshopper (probably *S. bicolor*) was red on the Red Sandstone in Devon. Owing to this great tendency to variation a number of names have been given to the various forms, and three are to some extent in use:

(1) *mollis* Charp.—the green form.

(2) *purpurascens* Fieb.—the reddish-purple form.

(3) *nigrina* Fieb.—the dark form.

Burr says there are in the Hope Collection in Oxford (with many others unlabelled) one male labelled "*crucigera*," and another male "Isle of Purbeck, 1830, *L. rubicunda*" [this apparently = *purpurascens* Fieb.]. *Rubicunda* has usually been referred to *O. viridulus* of which (as mentioned on p. 239) a reddish form is sometimes taken. A strikingly coloured form, *longitudinalis* Luc., has the dorsal surface including the elytra nearly black, while the legs and sides are yellow. It occurred in 1918 at Arthog in Merionethshire, and in the New Forest.

Date.—*S. bicolor* may be found as an imago for a longer period than the rest of our grasshoppers belonging to the Acridiodea. It begins to appear in June, and continues through July, August, September, and October, even into November. November the ninth is the latest date on which I have met with the species, the locality being at the Black Pond on Esher Common in Surrey.

Habits, etc.—So common is this grasshopper with us that it is not easy to give the kind of locality in which it may be sought. It does not like woods, but prefers open places, and such as are fairly dry; consequently it is often found on sandhills. It sometimes rests on walls or pailings. Morley found it on a first storey window-sill!

Distribution.—Common in Europe (Lapland, Norway, Sweden, Denmark, the British Isles, Holland, Belgium, France, Spain, Portugal, Switzerland, Germany, Austria); found also in Asia (Siberia, Mongolia, Corea, Japan, Asia Minor, Burma), and North Africa.

British Localities.

S. bicolor may fairly be looked upon as *the* British grasshopper, and may safely be said to occur throughout the British Isles. There are still, however, nine English counties for which I have no records. My list is as follows:

England.—*Bedfordshire:* Near Sharnbrook (*Lucas*). *Berks:*

White Horse Hill near the "Blowing Stone," near Letcombe Basset, and Chilswell Hill (*Lucas*); Crookham Common near Newbury (*Morley*); Wellington College and Tubney (*Hamm*); Bradfield College (*Chitty*); neighbourhood of Radley College (*Burr*). *Bucks:* Kingsley (*Lucas*); Pitstone (*Mrs. Ashby*). *Cambridgeshire:* Wicken, with vars. *mollis* and *purpurascens* (*Porritt*). *Cheshire:* Caldy, Heswall, Hoylake, Parkgate, and West Kirby (*Sopp*). *Cornwall:* The Lizard and Falmouth (*Shaw*); Widemouth Bay near Bude, with var. *purpurascens* occasionally (*Bracken*): Downderry on shore of Whitesand Bay, dull reddish-brown tint, also at Whitesand Bay Hotel, Sheirock, and Port Wrickle (*Yerbury*); Fowey (*Stowell*). *Cumberland:* Silloth, Allonby, and Wan Fell near Penrith (*Day*). *Derbyshire:* Dovedale (*Jourdain*). *Devon:* Common all over the county, very variable in colour (*Bignell*); the three named vars. occur (*Bracken*); near Dawlish (*Lucas*); Lynton and Lynmouth (*Briggs*); Sidmouth (*Rowden*); near Bideford (*Ansorge*); Starcross and the South Devon coast generally (*Porritt*). *Dorset:* Near Lulworth Cove, cliffs at Swanage, Chapman's Pool where very variable, near Portland, near Studland, Bincombe, and near Preston (*Lucas*). *Essex:* Strawberry Hill Loughton, and Epping Forest (*Campion*); Colchester (*Harwood*). *Gloucestershire:* (*Edwards*); Clifton near Bristol (*Pocock*). *Hants:* New Forest, Hurst Castle, near Lymington, and coast near Milton and Mudeford (*Lucas*); Whale Island Portsmouth (*Cant*); Bournemouth (*Winston*); Hayling Island (*Sharp*). *I. of Wight:* Yarmouth (*Lucas*); Sandown (*Holland*). *Herefordshire:* West Malvern and Huntsham Hill (*Tomlin*); near Downton (*Stowell*). *Hertfordshire:* Hemel Hempstead (*Gibbs*); St. Albans (*Duthie*). *Huntingdonshire:* Ramsey (*Campion*). *Kent:* Folkestone Warren, with vars. *mollis* and *purpurascens*, and Langdon Hole near Dover (*Burr*); Deal (*Porritt*); Blean Wood, Faversham District, and Staplehurst District (*Chitty*); Margate and Bostal Common (*Shaw*); Herne Bay (*Campion*); heard at Stonehall Farm near Lydden (*Burr*). *Lancashire:* Birkdale (*Whittaker*); Lathom and Ormskirk (*Score*); Cark-in-Cartmel, Cartmel, Hightown, Liverpool, Sefton Park, Scarisbrick and Silverdale (*Sopp*). *Lincolnshire:* Brumby Common, Sweetingthorne Wood, Torksey, Gate Burton, Newton Cliff, Caborne, and Marton Cliff (*Shaw*); Cadney (*Peacock*); Scotton Common, Boston, Kirton Marsh, and Crowland (*Thornley*); Mumby Chapel, Mablethorpe, Well Vale, Trusthorpe, and Cleethorpes (*Porritt*). *Isle of Man:* Douglas (*Porritt*); Laxey (*Shaw*);

Ballaugh, Dhoon Glen, Glen Mona, Point of Ayr, Andreas, Jurby, Kirk Midall, and Douglas Head (*Cassal*). *Middlesex:* Home Park Hampton Court (*Lucas*); Hadley Wood (*Shaw*); Acton, 1885 (*Winston*); Chiswick, 1906 (*Sich*); Paddington, 1901 (*Clarke*); Ealing, 1903 (*Walker*); Staines (*Campion*). *Norfolk:* Docking Common, with vars. *mollis* and *purpurascens*, Gunthorpe, Waxham, and Clay-next-the-sea (*Shaw*); Yarmouth (*Winston*); Hunstanton (*Porritt*); Wood Marsh Sutton (*Balfour-Browne*); King's Lynn (*Atmore*). *Northants:* Harleston (*Fieldsend*). *Notts:* Cottam, S. Leverton, N. Leverton, Bullwell Forest outside Nottingham, Clarborough, and Rampton (*Shaw*); Kingston-on-Soar, Everton Barrow Hills, with var. *mollis* (*Thornley*); Checkerhouse (*Houghton*); Retford (*Pegler*); Thorney (*Carr*). *Oxon:* Shotover Hill (*Lucas*). *Somerset:* Combre Florey near Taunton (*Jones*); Batheaston (*Blathwayt*). *Suffolk:* Mildenhall (*Perkins*, Camb. Univ. Museum); Wherstead, Dodnash Wood, Foxhall, Oulton Broad, Icklingham, Farnham, Aldeburgh, Felixstowe, Dunwich, Bramford, and Bentley Woods (*Morley*); Southwold (*Bloomfield*); Tuddenham (*Porritt*). *Surrey:* near Newland's Corner, Bookham Common, Prince's Coverts Claygate, Oxshott Heath, Esher Common, Boxhill, Downs near Ranmore, and between Denbies and Pickett's Hole (*Lucas*); Frensham Heath (*Thornley*); Boxhill, var. *mollis* (*McLachlan*) Kew Gardens (*Nicholson*); Roy. Hort. Society's Gardens, Wisley (*Wallis*); Colley Hill and Dorking (*Chapman*); Garden at Upper Tooting, and Horsley (*South*); Send (*Rawes*); Redhill (*Frisby*). *Sussex:* Ashdown Forest (*Burr*); Eastbourne (*South*); Hastings District (*Bloomfield*); Bognor (*Guermonprez*); St. Leonard's (*Shaw*); Beachy Head (*Stevens*). *Wilts:* Marlborough District (*Stowell*). *Yorkshire:* Castle Howard, Hayburn Wyke, and Scarborough (*Porritt*); Scunthorpe (*Bayford*); Red House Wood, Reighton Gap, and Marston (*Hewett*).

WALES. — *Anglesey:* (*Mason*); Llanfaethlu (*Morton*). *Carnarvonshire:* Mynydd Hill (*Stowell*); Penmaenmawr (*Porritt*). *Merionethshire:* Arthog (*Nevinson*). *Pembrokeshire:* Abundant, especially on shore, with green var. (*Jones*); Newport, with var. *purpurascens* (*Shaw*).

SCOTLAND.—Very common on the sea-banks, links, and coast sandhills along the east side of Scotland, and doubtless on the west too (*Evans*). *Argyll:* South end of Mull of Kintyre (*Stewart*). *Berwickshire:* Burnmouth (*Evans*). *Dumbarton:* Peaton, Loch Long (*Evans*). *Dumfries:* Ellangowan District (*McGowan*). *Elgin:* Forres (*Chitty*). *Fife:* Aber-

dour, Tentsmuir, and Kinghorn (*Evans*). *Haddington:* North of Tynemouth, Waughton, Port Seton, Dunbar, Luffness Links, type and var. *purpurascens*, North Berwick, and Gullane (*Evans*). *Mid Lothian:* Dalkeith Park (*Evans*). *Wigtown:* Near Kirkcowan Station, about 8 miles from the sea (*Brock*).

Ireland.—Wicklow, Dublin, Limerick, Kerry, and Louth (*fide Kemp*); near Limerick (*Shaw*). In Co. Dublin—Howth, Dalkey, Malahide, and Three Rock Mountain (*Shaw*).

5. **St. (Chorthippus) elegans** Charp.

(Plate XIX, fig. 7; Pl. XX, fig. 8; Pl. XXIII, fig. 9.)

elegans	Charp. Hor. Ent. p. 153 . .	1825—*Gryllus.*
„	Fisch. Orth. Eur. p. 318, n. 4, pl. i *b*, f. 11	1853—*Stenobothrus.*
„	Fieb. Lotos, iii, p. 117, n. 32 .	1853—*Chorthippus.*
„	Brunner Prod. der Eur. Orth. p. 125, f. 28 H . . .	1882—*Stenobothrus.*
„	Shaw Mon. Brit. Orth. in Ent. Mo. Mag. p. 418 . . .	1889—*Stenobothrus.*
„	Finot Faune de la Fr. Orth. pp. 111, 116, pl. vii, ff. 89, 90	1889—*Stenobothrus.*
„	Burr Brit. Orth. p. 37, pl. iii, f. 6	1897—*Stenobothrus.*
„	Burr Syn. Orth. W. Eur. p. 45	1910—*Chorthippus.*
Albomarginatus	Kirby Syn. Cat. Orth. iii, p. 185	1910—*Chorthippus.*
elegans	Lucas Proc. S. Lond. Ent. Soc. p. 31, pl. iv, f. 6 . . .	1913—*Chorthippus.*

(Other synonyms: *L. tricarinata* Steph.; *G. blandus* Fisch.-Waldh.; *Œ. dichroa* Eversm.)

Original Description.

Gryllus elegans.

Gr. capite valde declivi, thorace carinis tribus rectis.

Mas thoracis dorso rufescente, lateribus plerumque viridibus: elytris ut plurimum non coloratis, margine antico dilatato, corpore paullo longioribus.

Foemina mare multo major: linea atra thoracis, carinis lateralibus plerumque adhaerente: elytris oblongis (non dilatatis) corpore breviori-bus, laete viridibus aut rutilo-testaceis, vitta longa alba ad marginem anticum, cui altera atra, interdum satis lata, adjacet.

Habitat in Silesiae pratis humidis, in Hungaria, in Gallia meridionali. (Charpentier, 'Hor. Ent.' p. 153, 1825.)

[In 1773 De Geer described certain grasshoppers as *Acrydium albo-marginatum*. Kirby in his 'Catalogue' adopts this name in place of *C. elegans* for the species under consideration. Possibly De Geer had this species before him, and there may exist the means of knowing this; but the points of distinction employed seem scarcely sufficient

in themselves to make it certain. They depend chiefly on colour, and the white streak to which importance is attached is a female characteristic in several species. He mentions four forms which might or might not belong to the same species. So at present I content myself with quoting De Geer's description:

Criquet à étuis bordés de blanc.

7. *Criquet verd ou brun, à ventre gris & à étuis bordés de blanc.*

Acrydium (albo-marginatum) *viride seu fuscum*, abdomine *griseo*, *elytris albo marginatis*.

Ils sont au dessous de la grandeur médiocre, ou longs de près de neuf lignes, & on les trouve en quantité dans les prairies. Il y en a de trois variétés, mais tous ont une forme semblable, & ils conviennent tous entre eux, en ce que le côté extérieur des étuis est bordé de blanc, que le dessus du corcelet a de chaque côté une ligne longitudinale blanche élevée en arrête, & que le ventre est gris en dessus à taches noires & verdâtre en dessous. Ceux de la premiere variété ont la tête, le corcelet, les pattes & les étuis des ailes d'un verd de gramen foncé. Sur d'autres les côtés de la tête & du corcelet, avec la plus grande partie des pattes, sont verds, mais le dessus de la tête, & du corcelet & les étuis sont d'un brun griseâtre. Enfin il y en a encore d'autres, sur qui toutes ces parties sont d'un brun griseâtre & sur lesquelles on ne voit point de verd. J'en ai eu un quatrieme, dont le dessus de la tête & du corcelet avec les étuis étoient d'un brun rougeâtre ou tirant sur la couleur de chair, le reste étant verd.

Les antennes de tous ces Criquets sont brunes, de grosseur égale & de la longueur de la tête & du corcelet. Les étuis et les ailes de la femelle sont plus courtes que le corps. Les yeux à réseau sont d'un brun obscur, & on voit aussi sur la tête les trois petits yeux lisses.

(De Geer, 'Mém. Ins.' iii, p. 480, 1773.)]

Male Imago (Pl. XXIII, fig. 9).—General *colour* green or brown. *Length* 13–14 mm. *Verteæ* produced into a triangular point between the large and prominent eyes; *foveolæ* oblong, strongly marked; median *sulcus* of the frons long and deep with the ocellus well marked in the middle; *antennæ* long. Cross furrow of the *pronotum* almost in the middle; carinæ nearly parallel, but lateral ones approaching slightly forwards, and just lightly curved. *Elytra* (Pl. XX, fig. 8) fully developed, with the costa arched at the base. *Wings* fully developed, hyaline, slightly smoky at the tip.

Female Imago.—General *colour* as in the male. Considerably larger; *length* some 20 mm. *Elytra* and *wings* fully developed as in the male; but only reaching

(sometimes barely reaching) the apex of the abdomen. Elytra with a whitish streak between the two branches of the subcosta. Valves of the *oripositor* not much protruded, without an external tooth.

Variation.—At the Deal Sandhills *C. elegans* was found to be brownish in colour, harmonising with the soil, just as the green ones do with the grass in the New Forest (although brown examples occur there with the green). At Holmsley in the New Forest a few had the dorsal surface more or less rosy. The antennæ may be rosy except at the base, especially in some specimens.

Date.—August and September are the best months for this grasshopper, although apparently it is sometimes mature earlier.

Habits.—In the New Forest *C. elegans* is found in damp grassy spots, and it is reported from marshes at Burgh Castle and swamps at Sandwich Bay. On the other hand it is quite as frequently reported from sandhills; while Harwood found it on sea-walls at Colchester, and Yerbury in a saltmarsh at Walton-on-the-Naze. Possibly there is some factor in common to these various habitats, which on the surface is not apparent. While the males are active enough, the females do not jump at all well.

Distribution.—Although this species has a wide range on the Continent, Burr considers that it is not common. It has been reported from Sweden, Denmark, Holland, Belgium, British Isles, France, Germany, Austria, Hungary, Spain, Istria, Croatia, Transylvania, Moldavia, Serbia and Bosnia. Kirby also gives North and West Asia.

British Localities.

England.—*Berks:* Crookham Common near Newbury (*Morley*). *Cambridgeshire:* Wicken (*Porritt*). *Cheshire:* Ship Canal banks, Acton Grange (*Dunlop*); Leasowe (*Sopp*). *Dorset:* Weymouth (*Briggs*). *Essex:* Leigh (*Briggs*); Col-

chester (*Harwood*); Walton-on-the-Naze (*Yerbury*). *Kent:* Deal (*Briggs*); Sheppey (*Chitty*); Sandwich, Sandwich Bay, and Ham Ponds (*Burr*); Herne Bay (*Campion*). *Hants:* New Forest (*Lucas*); Aldershot (*Sopp*). *I. of Wight:* Freshwater Bay, Freshwater Swamp, and Parkhurst Forest (*Burr*); Ventnor (*Morley*). *Lancashire:* Grange-over-Sands and Silverdale (*Sopp*). *Lincolnshire:* Mablethorpe (*Wallis-Kew*); Ingoldmells (*Peacock*); Mumby Chapel and Well Vale (*Mason*); Kirton Wash near Boston (*Thornley*); Trusthorpe and Sutton-on-Sea (*Porritt*). *Middlesex:* Acton (*Winston*); Wormwood Scrubs (*Shaw*). *Norfolk:* King's Lynn (*Atmore*); Hockham and near Waxham (*Shaw*); Hunstanton and district (*Porritt*); Horning and Eley (*Edwards*). *Suffolk:* Southwold (*Bloomfield*); Burgh Castle and Tuddenham Fen (*Morley*); Mildenhall (*Perkins*). *Surrey:* Tilford and Hale (*Sopp*); Boxhill (*West*). *Sussex:* Ewhurst (*Bloomfield*); Willingdon (*Sopp*); Eastbourne (*Waterhouse*); Pagham Marsh (*Guermonprez*).

Porritt took it at Penmaenmawr in N. Wales; and it occurs in Ireland (*fide Kemp*).

6. **St. (Chorthippus) parallelus** Zett.

(Plate XIX, fig. 8; Pl. XX, fig. 9; Pl. XXIII, fig. 7.)

parallelus	ZETT. Orth. Suec. p. 85, n. 6 . .	1821—*Gryllus.*
,,	BRUNNER Prod. der Eur. Orth. p. 127, n. 27	1882—*Stenobothrus.*
,,	SHAW Mon. Brit. Orth. in Ent. Mo. Mag. p. 418	1889—*Stenobothrus.*
,,	FINOT Faune de la Fr. Orth. pp. 111, 129, pl. vii, f. 94	1889—*Stenobothrus.*
,,	BURR Brit. Orth. p. 38, pl. iii, f. 7 .	1897—*Stenobothrus.*
,,	BURR Syn. Orth. W. Eur. p. 46 .	1910—*Chorthippus.*
Parallelus	KIRBY Syn. Cat. Orth. iii, p. 186 .	1910—*Chorthippus.*
parallelus	LUCAS Proc. S. Lond. Ent. Soc. p. 31, pl. iv, f. 7	1913—*Chorthippus.*

(Other synonyms:—*G. montanus* Charp.; *P. tenuis* Brullé; *P. dimidiata* Brullé; *C. pratorum* Fieb.)

ORIGINAL DESCRIPTION.

6. G. parallelus thorace tricarinato, carinis lateralibus subrectis; supra lateribusque viridis, subtus flavicans, geniculis pedum posticorum nigris; hemelytris in mare paullo, in femina abdomine duplo, breviora, in utroque sexu pallescentia, unicolora.

Hab. in pratis Gottlandiae, Ölandiae, Ostrogothiae & Scaniae, mens. Julio & Augusto, parcius; a D. Boheman e Smolandria quoque com-

municatus; & alia vice a D. Marklin, patria non indicata. Fortiter stridet. Mores praecedentis. [*Gryllus dorsatus.*]

Descr. I. v. *Mas & Fem.* Statura prioris, magnitudine minori, inprimis maris, qui femina duplo minor; differt praecipue a praecedente capite thoraceque totis virescentibus, hemelytris brevioribus, unicoloribus, & pedum posteriorum geniculis nigris. *Caput* cum *antennis* & *oculis* omnino ut in praecedente constructum, colore viridi. *Thorax* etiam ut in illo, totus virescens. *Hemelytra* in mare abdomine paullo (circiter linea) breviora, pallida, immaculata; in femina dimidiam abdominis partem vix attingunt, tota viridia, unicolora. *Abdomen* dorso aut viridi-fuscum, aut brunneum, lateribus saepe nigro-maculatum, ventre dilutiori. *Differentia sexus* ut in prioribus. *Pedes* glabri, testacei, posticorum femoribus supra viridibus, subtus flavis geniculis nigris, saltem fuscis. *Pulvilli* perspicui.

Variat ♂. antennis totis testaceis; variat etiam femina tota obscura vel pallida.

Obs. Hanc speciem, quae omnino distincta videtur, in copula deprehendere mihi adhuc non contigit. Femina an rite explicata? Pupas sexus masculi cum imaginibus saepe inveni.

(Zetterstedt, 'Orthoptera Sueciae,' p. 85, 1821.)

Male Imago (Pl. XXIII, fig. 7).—*Colour* very variable, usually brown, or a great part green, small. *Length* 12–13 mm. *Antennæ* long. *Vertex* produced as a triangle between the eyes; *foveolæ* very unpronounced; median sulcus of the frons deep, with ocellus conspicuous nearer the top. Cross furrow of *pronotum* nearer the hind margin; carinæ somewhat parallel, but less so than in *C. elegans*; lateral ones curved inwards in front of the cross furrow. *Elytra* (Pl. XX, fig. 9), fully developed; reaching nearly to the tip of the abdomen; usually pale brown, without spots; costa arched at the base. *Wings* abortive; about 2·5 mm. long.

Female Imago.—*Colour* even more variable than in the male. *Size* much larger. *Length* some 20–22 mm. *Antennæ* shorter and more slender. Lateral carinæ of *pronotum* somewhat more parallel than in the male. *Elytra* green or brown, abbreviated, rhomboidal; costa arched at the base. *Wings* abortive, about 3 mm. long. *Ovipositor* somewhat blunt, rather prominent; without external tooth.

Variation.—*C. parallelus* is a very variable insect, the female particularly. Usually the tendency is in one of two directions—towards brown or towards

green. A pretty form is one in which there is a pronounced rosy tinge. In the New Forest I once met with a green female having a yellow-brown dorsal streak along the thorax, elytra and abdomen—a rather striking form. Two females from Ashburn in Derbyshire had a yellow line along the costal region of the elytra. *G. montanus* Charp. is a rare form with elytra and wings perfectly developed in both sexes (Shaw). Specimens found in marshy spots, however, with more fully developed wings and the valves of the ovipositor long and noticeable might perhaps be *C. longicornis* Latr.

Date.—This grasshopper is mature about the beginning of July. It may be found as an imago in July, August, September and October, finally disappearing about the end of the last-named month. My latest capture took place in fact on the 31st of October.

Habits, etc.—Meadows and open ground constitute the usual habitat of this very common grasshopper. Possibly it prefers ground that is inclined to be damp rather than too dry. It may be captured by sweeping, but since it cannot fly, it is easily taken by hand. Seeing that the poor development of its organs of flight will not allow of its making long flying leaps, the liability to vary may be useful to some extent in its struggle for existence; for the result seems often to be a general resemblance to its environment. This species, also, feeds on grass, holding the leaf or stem in the usual way with its fore legs and eating along the margin of the leaf.

Distribution.—One of the commonest of European grasshoppers, it is found throughout the Continent, and occurs also in Northern and Western Asia.

British Localities.

We have a large number of records for *C. parallelus* in England, a few for Wales, a fair number for Scotland, but apparently none for Ireland.

England.—*Berks:* Crookham Common near Newbury (*Morley*); Chilswell Hill near Oxford, White Horse Hill near the "Blowing Stone," and near Letcombe Basset (*Lucas*); Wantage (*Holland*); neighbourhood of Radley College (*Burr*). *Bucks:* Kingsley and near Ilmer (*Lucas*). *Cheshire:* Acton Bridge (*Pearse*); Thurstaston (*Coward*): Bidston, Leasowe, Hoylake, and West Kirby District (*Sopp*). *Cornwall:* Lizard and Falmouth (*Shaw*); common in N. Cornwall (*Bracken*); Widemouth Bay near Bude (*Bracken*); Lelant and Sheirock (*Yerbury*); Fowey (*Stowell*). *Cumberland*: Salkeld and Wan Fell (*Day*). *Derbyshire:* Holt Wood, Clifton near Ashburn (*Jourdain*); common in several localities in the Ashburn District (*Jourdain*); Kirk Ireton (*Abell*). *Devon:* Common in fields and meadows (*Bignell*); generally distributed (*Bracken*); Stoke Woods Exeter (*Rowden*); near Bideford (*Ansorge*); Dartmoor (*Shaw*); Beer (*Lyle*). *Dorset:* Near Lulworth Cove, cliffs near Swanage, Chapman's Pool, Bincombe, Upwey, and near Preston (*Lucas*); Eype and Evershot (*Shaw*). *Essex:* Epping Forest (*Shaw*); Colchester (*Harwood*). *Gloucestershire:* (*Edwards*); Clifton (? county), 1885 (*Pocock*). *Hants:* New Forest and Hengistbury Head (*Lucas*); Bournemouth (*Shaw*); near Eastleigh (*Edwards*). *I. of Wight:* Yarmouth and Cowes (*Lucas*). *Herefordshire:* Near Downton (*Stowell*); West Malvern and Huntsham Hill (*Tomlin*). *Hertfordshire:* Hemel Hempstead (*Gibbs*). *Kent:* Langdon Hole near Dover, and Folkestone Warren (*Burr*); heard at Stonehall Farm near Lydden (*Burr*); Deal, Staplehurst District, and Faversham District (*Chitty*); Herne Bay (*South*). *Lancashire:* Ainsdale (*Coward*); Birkdale, Flookburgh, Grange-over-Sands, Kent's Bank, and Southport (*Sopp*); Lathom and Ormskirk (*Score*). *Lincolnshire:* Brumby Common, Gate Burton, Trentside, Brandon, Cabourne, Caistor, Hundon Manor, and Santon (*Shaw*); Scotton Common (*Thornley*); Well (*Porritt*). *Middlesex:* Ealing (*Walker*); Harrow Weald (*Priske*); Willesden and Acton (*Shaw*). *Norfolk:* Ringstead Downs, Hunstanton (*Porritt*); Thursford (*Shaw*); King's Lynn (*Atmore*). *Northants:* Harleston (*Fieldsend*). *Notts:* Treswell Wood, Clarborough, Welham, and Cottam (*Shaw*); Kingston-on-Soar and Retford District (*Thornley*); Thorney (*Carr*). *Oxon:* Blenheim Park, 1832 (Hope Collection, Oxford); Shotover Hill (*Lucas*). *Somerset:* Combre Florey near Taunton (*Jones*); Batheaston (*Blathwayt*). *Staffordshire:* Ellastone (*Jourdain*). *Suffolk:* Ipswich, Bramford, Wherstead, Alderton, and Aldeburgh (*Morley*); Tostock (*Tuck*). *Surrey:* Kew Gardens, near Newland's

Corner, Merrow Downs, Boxhill, Ashtead Woods, Byfleet Canal, near Wisley, Wisley Common, near Effingham Station, Arbrook Common, Esher Common, Oxshott Heath, and Bookham Common (*Lucas*); Send (*Rawes*); Redhill (*Frisby*); Richmond Park and Wimbledon Common (*Shaw*); Dorking (*Chapman*). *Sussex:* Polegate (*Waterhouse*); Hastings and Eastbourne (*Shaw*); Bognor (*Guermonprez*); Beachy Head (*Adkin*); Guestling, etc., in Hastings District (*Bloomfield*); Ashdown Forest (*Burr*). *Warwickshire:* Between Warwick and Leek Wootton (*Lucas*); Offchurch (*Chitty*). *Wilts:* Marlborough District (*Stowell*). *Yorkshire:* Huddersfield, Askern, and Thorne (*Porritt*); Strensall Common (*Hewett*).

WALES.—*Carnarvonshire:* Mynydd Hill (*Stowell*); Penmaenmawr (*Porritt*). *S. Wales* (*Chitty*). *Pembrokeshire:* (*Jones*), Newport (*Shaw*).

SCOTLAND.—*Aberdeen:* Lumphanan (*Morton*). *Argyll:* Loch Awe (*Evans*); nymphs at Lochgoilhead (*Shaw*). *Dumbarton:* Coulport, east side of Loch Long (*Evans*). *Dumfries:* Ellangowan District (*McGowan*). *Fife:* Tentsmuir (*Evans*). *Haddington:* Dean Burn above Pogbie (*Evans*). *Inverness:* Upper Glen Spean (*Evans*). *Lanark:* Elvanfoot (*Evans*). *Linlithgow:* Boness (*Evans*); Drumshoreland (*Brock*). *Mid Lothian:* Bavelaw Moss, and near Glencol Reservoir, Pentlands (*Evans*). *Perth:* Balquhidder, and Rannoch Moor, near head of Loch Laidon (*Evans*). *Sutherland:* Near Rogart and Lairg (*Munro*); nymphs at Lochinver (*Verbury*).

CASUAL SHORT-HORNED GRASSHOPPERS, ETC.

Gomphocerus sibiricus Linn.—One specimen, in the Hope Collection at Oxford, "was captured on the hills near Netley." Being a native of South and Central Europe, and of Asia, it is scarcely likely to have been anything more than a casual. It may be recognized by (i) its swollen fore tibiæ, (ii) its unicolorous anteunæ, and (iii) its being without spots.

Pachytylus migratorius Linn. and **Pachytylus danicus** Linn. (= *cinerascens* Fabr.). These are migratory locusts, which occasionally straggle as far as the British Isles (and of course may also be introduced casually). There is, however, much confusion in the records of the two. In some years—1842, 1846, 1847, 1857, 1876, etc.—flights seem to have reached us. Though many have been recorded as *P. migratorius*, probably most were *P. danicus*, the former inhabiting Eastern Europe, while the latter is a resident in France, if not in Belgium. The following points may assist in separating the two species: *P. migratorius* has the pronotum rounded, and not much raised; hind tibiæ yellow or livid; size about the same in both sexes. *P. danicus* has the pronotum ending, both before and behind, in a blunt point, and more raised than in the other species; hind tibiæ reddish; female considerably larger than the male. Moreover, as

already mentioned, while *P. migratorius* is an eastern species rarely extending even to France, *P. danicus* is more western in its range and breeds in the south of France.

Œdipoda cærulescens Linn. occurs as a casual occasionally; it is resident in the Channel Islands. Its wings—pale blue with a black band—make it a conspicuous insect, when those organs are spread.

Acridium ægyptium Linn. has occurred casually a considerable number of times, having been introduced apparently with fruit or vegetables. It is a south European species, the nearest breeding place to us being the south of France. It is a very large dark greyish insect with base of wings smoky and part of hind legs purplish. The nymphs may be yellow or green.

Schistocerca peregrina Oliv. (= *tartarica* Linn.). In 1869 this migrant arrived in the British Isles in considerable numbers, reaching at least as far north as Burton-on-Trent. There is no record of its occurrence since that date. This is the large locust—light reddish in colour, with paler spots and markings—which does so much damage in Algeria.

(**Podisma pedestre** Linn. (= *Pezotettix pedester*) has got into our older lists through a mistake for *Chorthippus parallelus*. Its elytra are rudimentary and the hind tibiæ bright blue.)

(**Psophus stridulus** Linn. was given as British in Stewart's 'Elements of Nat. Hist.' 1805, ii, p. 95, but no doubt through a mistake. It is a rather large handsome insect, having vermilion wings tipped with black.)

APPENDIX.

Orthoptera of the Channel Islands.

Although the Channel Islands cannot be considered as belonging to the British biological area, still it will not be out of place to notice the species of Orthoptera that have been recorded as occurring there. As a matter of fact, however, very few species have been put on record, and it is evident that the orthopterous fauna stands as much in need of investigation in these islands as it does in so many parts of the British Isles. Of the seventeen species reported (in one or two cases doubtfully), four—*Stauroderus vagans*, *Omocestus hæmoroidalis*, *Œdipoda cærulescens*, and *Chorthippus pulvinatus*—are not British Insects. The Orthoptera of the Channel Islands at present known are:

Forficula auricularia Linn.—Guernsey and Alderney (*Luff*); Sark (*Shaw*); seems to be common in all the islands (*Burr*); var. *forcipata* taken in the Islands of Libou and Chapelle Dom Hue (*Luff*).

Labia minor Linn.—Abundant in Guernsey (*Luff*).

Ectobius panzeri Steph.—Found in Guernsey, common in Alderney (*Luff*).

Ectobius perspicillaris Herbst.—Common in Guernsey and Alderney (*Luff*).

Blattella germanica Linn.—Guernsey (*Luff*); received from Guernsey (*Bloomfield*).

Blatta orientalis Linn.—Guernsey (*Luff*).

Periplaneta americana Linn.—Guernsey (*Luff*).

Gryllotalpa gryllotalpa Linn.—Dalgleish was accustomed to receive living examples from Guernsey (*in litt.*, 23 March 1911); (also *Luff* and *Bloomfield*).

Gryllus domesticus Linn.—Houses in Guernsey (*Luff*).

Metrioptera albopunctata Goeze.—Common in Guernsey (*Luff*); received from Guernsey (*Bloomfield*); Sark (*Shaw*); received from Jersey (*Cartwright*).

Phasgonura viridissima Linn.—Common in Guernsey (*Luff*).

Tetrix subulatus Linn.—Common in Guernsey (*Luff*).

Omocestus hæmoroidalis Charp.—One specimen from Jersey (*Cartwright*).

Stauroderus vagans Fieb.—In Jersey, apparently rather common (*Cartwright*); Burr says doubtfully indicated for Jersey. This species is very like *S. bicolor*, but the carinæ of

the pronotum are more rounded at the angles and the transverse furrow is nearer the hind margin; whereas in *S. bicolor* it is nearer the fore margin and the sternum is hairy.

Stauroderus bicolor Charp.—Guernsey and Sark (*Shaw*); abundant in Guernsey (*Luff*); common in Jersey (*Cartwright*).

Chorthippus pulvinatus Fisch. de W.—Doubtfully recorded for Jersey (*Burr*).

Œdipoda cærulescens Linn.—Not uncommon in Guernsey, also from Jersey (*Luff*).

Corrigenda.

p. 86, line 22, *for* "Eobatta" *read* "Eoblatta."

p. 145, lines 32 and 33, constituting a record of "Gryllacris," should be omitted here. They appear correctly on p. 198.

p. 249, lines 30 and 31, *for* "Les étuis les ailes" *read* "Les étuis et les ailes."

p. 252, line 11, *for* "aut viridi fuscum" *read* "aut viridi-fuscum."

SYSTEMATIC INDEX

(*Synonyms and varietal names in italics.*)

abdominale 234
acanthopygia (Chelidurella) 14
acervorum (Myrmecophila) 145
Acheta 121, 134
Acrida 134, 176
Acridiidæ 5, 200
Acridiodea 5, 6, 146, 200
Acridium 206
Acrydium 206
ægyptiaca (Blatta) 93
ægyptium (Acridium) 256
Aetolica (Forficula) 54
affinis 21
africana (Blatta) 93
albifrons (Tettigonia) 198
albipennis (Apterygida) 6, 10, 11, 14, 58
albo-marginatum (Acrydium) 248, 249
albopunctata (Metrioptera) 6, 148, 150, 157, 158, 163, 168, 257
alpinus 162
americana (Periplaneta) 6, 65, 68, 71, 72, 100, 101, 109, 110, 115, 257
amurensis 21
Anapterygota 3
Anisolabis 15
Anisoptera 184
annulicornis 15
annulipes (Anisolabis) 6, 10, 12, 14, 15, 61
annulipes (Forficesila) 16
Anoplura 3
antennata 15
antennatus 221
antoni 15
aprica 238
aptera 151
Apterygida 58
Apterygota 3
arachidis (Prolabia) 6, 10, 13, 14, 35, 61
arboreus 189
arenicola 81
Arixeniidæ 13
Arixenius 5
asynamorus (Tachycines) 198
auditor 21
aurantiaca 101
aurelianensis 101
auricularia (Forficula) 6, 10, 11, 14, 39, 56, 60, 61, 257
australasiæ (Periplaneta) 6, 64, 67, 71, 72, 100, 102, 105, 115
autumnalis 194

bicolor (Stauroderus) 6, 202, 203, 205, 237, 241, 242, 257, 258
bicolor 21
biguttatus 221, 224
biguttula 243
biguttulus 243
bilineata 21
bimaculatum 207
bimaculatus (Gryllus) 136, 145
bingleii 172, 174
binotatum 212
bipunctatum 207
bipunctatus (Tetrix) 6, 206, 208, 209, 211, 212
bispina 166
bivittata 21
bivittata (Nauphæta) 117
Blaberidæ 63

blandus 248
Blatta 93
Blattella 85, 86, 102
Blattidæ 5
Blattodea, 5, 6, 62
borealis 39, 40, 45
bormansi 15
Brachylabis 15
brachyptera (Metrioptera), 6, 148, 150, 157, 161, 168, 169, 171
brazzæ (Nauphæta) 117
brevipennis 165
brevirostre (Lirometopum) 199
brunnea (Nyctibora) 116
Bulla 134, 206
burmeisteri (Epilampra) 116
buyssoni 174, 176

Cacerlaca 100
cærulescens (Œdipoda) 256, 257, 258
calidoniensis 221
Callimenidæ 146
campestris (Gryllus) 6, 121, 135
Campodea 9
Campodeioidea 2, 3
caraibæa (Epilampra) 116
caudata 136
celebesa 111
centralis (F.) 61
Chelidoptera 157
Chelisochidæ 13
Chorisoblatta 86
Chorthippus 231
cinerascens (Pachytylus) 226, 229
cinerea 117
cinereus 151
circumvagans (Nauphæta) 117
clarki 21
clavicorne 218
clypeata 151
clypeatum (Xiphidium) 156
Coleoptera 3
Collembola 2, 3
Conocephalidæ 146, 147
Conocephalus 176, 184
concolor 81
conspicua 46
cophta 125
Copiophora 198
Copiscelis 28
cornuta (Copiophora) 198
corticum 111
Corydidæ 63
cristatum 212
crucigera 245
cruentata 234
cubensis (Blabera) 117
Cursoria 5
Curtilla 121
cyclolabia 40

danicus (Pachytylus) 255, 256
decipiens (Forficula), 46, 53, 54
decorata (Stylopyga) 116
Decticidæ 146, 147
Decticus 171
Demogorgon 20, 23
dentata 40
denticulata 158
Dermaptera 4, 5, 7
Dermatoptera 7
dichroa 248
Dictyoptera 4, 5
diluta 166
dimidiata 251
dimidiatus 238
Diptera 3
discolor 184
distincta 21
domesticus (Gryllus) 6, 119, 121, 135, 139, 257
domingensis 105
dorsale 207
dorsalis (Conocephalus) 6, 148, 150, 184, 199
douvillei (Palæoblattina) 69
dubronii 21
dumonti 21

Ectobia 73, 117
Ectobiidæ 63
Ectobius 66, 73, 80, 102
elegans 221

elegans (Chorthippus) 6, 202, 206, 248
Embioptera 3
emittens 105
Endopterygota 3
Eneopteridæ 118
Eoblatta 86
Ephemeroptera 2, 3
Ephippigera 193
Ephippigeridæ 146
ephippium 212
Epilampridæ 63
cricetarius 221
ericetorum 81
Euorthoptera 5
Euplekoptera 7
Euplexoptera 7
exoleta (Panchlora) 116, 117
Exopterygota 3

falcata 158
falcata (Phaneroptera) 147, 199
falcatus 189
finschiana (Eurycotis) 116
fischeri 21
flavipes 226
flavipes (Locusta) 226, 230
Focarius (Grillus) 145
Forcinella 15
forcipata 10, 39, 40, 45, 46, 52, 257
Forficesila 15, 20
Forficula 12, 15, 39
Forficularia 7
Forficulidæ 5, 7, 13
Forficulina 7
forficulina (Baseopsis) 8
Forficulodea 5, 6, 7, 63
fusca 184
fuscum (Xiphidium) 199
fuscus (Conocephalus) 186
fuliginosus (Tetrix) 214

gallicus (Bacillus) 5
geniculata 234
Geoscapheusidæ 63
germanica 74, 81
germanica (Blattella) 6, 71, 72, 77, 86, 87, 98, 100, 103, 257
germanicus 226
gerstæckeri (Discritina) 2
gigantea 21, 27
gigantea (Blabera) 117
gigantea (Blatta) 93
glabricauda 194
Gomphocerus 217
Gryllacridæ 146
Gryllacris 198
Gryllidæ 5, 118, 120
Gryllodea 5, 6, 118
Gryllodes 145
Grylloids 120
Gryllotalpa 121
gryllotalpa (Gryllotalpa) 6, 68, 119, 121, 122, 257
Gryllotalpidæ 118, 119
Gryllus 134
granulosa 21
gravidula 35
griseo 158
grisea (Epilampra) 116
griseoaptera (Pholidoptera) 6, 148, 150, 151
grossus (Gryllus) 230
grossus (Mecostethus) 6, 202, 205, 226
gybbum 212

hæckeli 83
hæmoroidalis (Omocestus) 257
hæmorrhoidalis 243
hebræus (Gryllodes) 145
helvetica 74
Hemimeridæ 13
Hemimerus 5
hemiptera 74
Hemiptera 3
herculeana 21
Hetrodidæ 146
holosericea (Nyctibora) 116
huseinæ 21
Hymenoptera 3, 4

inclusa 105
indica 111

inermis 21
infumata 40
Isoptera 3

Kakerlac 93, 99
kakkerlac 101
karschi 21

Labia 28, 36
Labidura 20
Labiduridæ 13
Labidurinæ 14
Labiidæ 13
Labiinæ 14
lapponicus (Ectobius) 6, 64, 68, 71, 72, 73, 74, 78, 79, 80, 82, 88, 117
Lepidoptera 3
Leptophyes 150, 193, 195
lesnei (Forficula) 6, 10, 11, 14, 53, 59, 60
leucogramma (Phoraspis) 116
Leucophæa 111
lewisi (Anechura) 61
lineare (Doru) 61
lineatus (Stenobothrus) 6, 202, 204, 205, 232
linnei 212
Liogryllus 134
livida (Ectobia) 78
Locusta 134, 176
Locustidæ 5, 146, 147
Locustodea 5, 6, 119, 120, 146
longicornis (Chorthippus) 253
longipennis 21
longisetosa (Dyscritina) 2
longitudinalis 245
lucida 74
lurida 40
lunulatum 212

macrolabia 40
macroptera 162, 166
maculatus (Gomphocerus) 6, 164, 202, 203, 206, 221, 240
maderæ (Rhyparobia) 71, 111, 116
major 40
Mallophaga 3
Mantidæ 5
Mantis 134
Mantodea 5
Margattea 86
marginata 162, 207
marginatus 238
marginella 21
maritima (Anisolabis) 15, 61
marmorata (Diestrammena) 198
Mastacidæ 200
maxima 21
Meconema 189
Meconemidæ 147
Mecopodidæ 147
Mecostethus 225
media 39, 40, 45
media (Apterygida) 58
megacephalum 232
melanocephala 111, 114
Metrioptera 157
Micropteryx 151
migratorius (Pachytylus) 255, 256
miniata 234
minor (Labia) 6, 7, 10, 13, 14, 29, 257
minuta 29
mixta 21
mollis 243, 244, 246, 247
mongolica 21
montanus 251, 253
morbida 21
morio (Chelisoches) 61
Myrmecophilidæ 118

nana 189
natalensis 116
Nauphæta 69
neglecta 39, 40
Nemobius 130
Neoblattella 86
Neuroptera 3
niger (Leucophæa) 111
nigrina 244
nigripennis 35
nigripes 81, 82, 83, 85
nigrofusca 74
nigroterminatum 238
nivea (Blatta) 93

nivea (Panchlora) 117
nutans 212
Nyctiboridæ 63

oblongata (Blatta) 93
obscura 212
obscurus (Pycnoscelus) 111
occipitalis 111
Odonata 2, 3, 4
Œcanthidæ 118
Œdipodidæ 200
Olynthoscelis 151
Omocestus 231, 238
opacum 212
orientalis (Blatta) 6, 67, 68, 71, 72, 89, 90, 94, 102, 103, 107, 113, 115, 257
Orthoptera 3, 6
Oxyhaloidæ 63

pallens (Ectobius) 117
pallidus (Ectobius) 79, 80
pallipes 21
Pamphagidæ 200
Panchlora 111, 116, 117
Panchloridæ 63
Panesthiidæ 63
panzeri 207
panzeri (Ectobius) 6, 64, 71, 72, 73, 81, 257
parallela 40
parallelus (Chorthippus) 6, 202, 203, 206, 219, 251, 256
Paraneuroptera 3
pedester (Pezotettix) 256
pedestre (Podisma) 256
pedestris 58
pellucens (Œcanthus) 145
pellucida 166
peregrina (Schistocerca) 256
Periplaneta 100
Periplanetidæ 63
Perisphæriidæ 63
perspicillaris (Ectobius) 6, 64, 71, 72, 73, 74, 76, 78, 257
Phasgonura 176
Phasgonuridæ 146
Phaneropteridæ 147, 195
Phasmidæ 5
Phasmodea 5
Pholidoptera 151
Phyllodromia 85, 86, 117
Phyllodromiidæ 63
Platycleis 157
Plecoptera 2, 3
Pneumoridæ 200
pœcila (Leucophæa) 111
pratorum 251
privata (Phaneroptera) 199
Prochilidæ 147
Prolabia 35, 36
Pronemobius, 130
Proscopiidæ 200
Protura 2, 3
Psalinæ 14
Pseudophyllidæ 147
Psocoptera 3
pubescens (Forficula) 53, 54, 55, 57
pulla 221
pulvinatus (Chorthippus) 257, 258
punctata 111
punctatissima (Leptophyes) 6, 147, 148, 150, 155, 159, 194
purpurascens 244, 245, 246, 247, 248
Pycnoscelus 111
Pygidicranidæ 13
Pyrgomorphidæ 200

quadripunctata (Phaneroptera) 199

religiosa (Mantis) 5
repanda 105
reticulatus (Homœgryllus) 145
rhombifolia (Dorylæa) 116
rhomboidea 243
riparia (Labidura) 6, 10, 11, 14, 21
roeseli 166
roeselii (Metrioptera) 6, 148, 150, 157, 163, 165
rubicunda 239, 245
rubicundus 238
rubripes 226
rufipes (Omocestus) 6, 202, 205, 234, 239
rufomarginatum 238

rufus (Gomphocerus) 6, 202, 203, 206, 217, 218, 223

Sagidæ 146
sahlbergi 209
Saltatoria 5
saturalis 21
sausurii 221
schrankii 212, 214, 217
scutellatum 212
sericea (Nyctibora) 116
sibiricus (Gomphocerus) 255
siccifolia 101
silana (Forficula) 46
sinensis 21
sinuatus 166
Siphonaptera 3
Standishi 194
staphylinus (Campodea) 2
Stauroderus 231
Stenobothrus 203, 217, 230, 231
Stenopalmatidæ 146
Stetheophyma 225
stolida 101
Strepsiptera 3
striata 158
striatus 207
stridulus (Psophus) 256
strigosa (Ischnoptera) 116
stylifer 211
Stylopyga 93
subcincta 105
submarginata 111
subornata 105
subulatus (Tetrix) 6, 206, 207, 214, 215, 257
Supella 86
surinamensis (Leucophæa) 6, 71, 72, 102, 111
sylvestris 74
sylvestris (Nemobius) 6, 119, 121, 130

talpa 122
tartarica 256
tenellus 232
tenuis 251
terminalis 21
Tetrigidæ 200
Tetrix 200, 201, 202, 203, 206
Tettigonia 134, 171, 176
Tettix 206
thalassinum (Meconema) 6, 148, 150, 189
Thamnotrizon 151
thymifolia (Ducetia) 199
Thysanoptera 3
Thysanura 2, 3, 4
Tolmis (Forficula) 54
tricarinata 248
Trichoptera 3
Tridactylidæ 118
Trigonidiidæ 118, 119
truncata (Heminyctibora) 116
Truxalidæ 200
Tympanophoridæ 146

vagans (Stauroderus) 257
variicornis 15
varipes 243
varium 189
varius (Gryllus) 193
venosa 243
ventralis (Gryllus) 234, 235
verrucivora (Tettigonia) 6, 148, 150, 172, 177
virescens 194
virescens (Panchlora) 117
viridis (Panchlora) 117
viridissima (Phasgonura) 6, 147, 148, 150, 177, 257
viridissimus minor 189
viridulum 234
viridulus (Omocestus) 6, 202, 205, 236, 237, 238, 245
vittata 243
vittipes (Agrœcia) 199
vulgaris 122

wallacei 35

Xiphidion 184
Xiphidium 184
xyphothyreum 212

Zetterstedtii 234
zonata 105
Zoraptera 2, 3

ADLARD AND SON AND WEST NEWMAN, LTD., LONDON AND DORKING.

EXPLANATION OF THE PLATES.

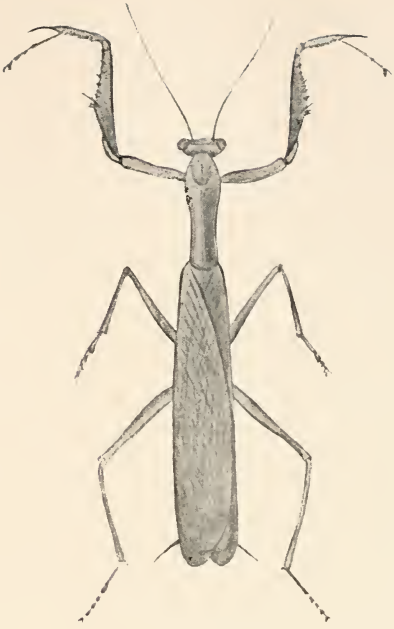
Plate 1

PLATE I.

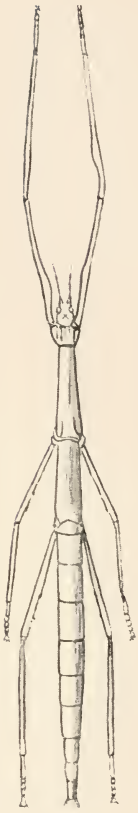
Fig.

1. *Mantis religiosa* Linnæus. (p. 5) × 1.
2. *Bacillus rossii* Fabricius, female. (p. 5) × abt. ·67.
3. *Campodea* sp. (p. 2) × 11.
4. Very young nymphal earwig. (p. 2) × abt. 15.

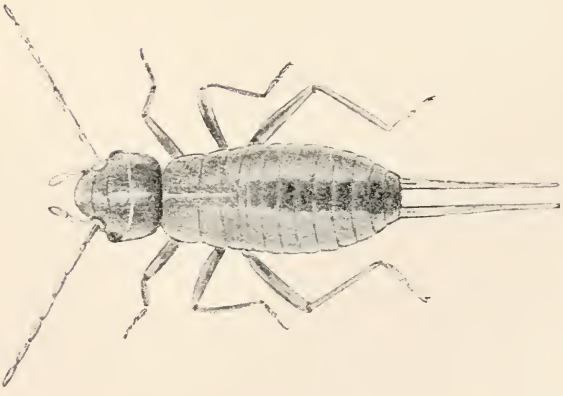
3



1



2



4

Plate 2

PLATE II.

Photograph of the males of the British earwigs, for comparison as regards size and appearance. × 1·7.

Fig.

1. *Labia minor* Linnæus. (p. 29)
2. *Labidura riparia* Pallas. (p. 21)
3. *Prolabia arachidis* Yersin. (p. 35)
4. *Anisolabis annulipes* Lucas (H.). (p. 15)
5. *Apterygida albipennis* Megerle. (p. 58)
6. *Forficula auricularia* Linnæus. (p. 39)
7. *F. auricularia*, var. *forcipata* Stephens. (p. 45)
8. *F. lesnei* Finot. (p. 53)

1
2
3
4
5
6
8

Plate 3

PLATE III.

Figs.

1, 2. *Labidura riparia* Pallas, drawn from living examples taken on the Hampshire coast in 1912. (p. 21)
Fig. 1.—Male. Fig. 2.—Female. × 2·5.

1

2

Plate 4

PLATE IV.

Fig.

1. Habitat of *Labidura riparia* Pallas on the Hampshire coast. (p. 23)
2. *L. riparia,* male and female, the former in "threatening attitude." (p. 24) Under nat. size.
3. *L. riparia,* male, cowering on the sand. (p. 24) Nat. size.

1

2 3

Plate 5

PLATE V.

Figs.

1, 2, 3. *Anisolabis annulipes* Lucas. (p. 15) Fig. 1.—Female imago. × 3. Fig. 2.—Antenna. × 12. Fig. 3.—Callipers of male. × 7·5.

4. *Prolabia arachidis* Yersin. (p. 35) Male imago. × 3.

5, 6. *Forficula lesnei* Finot. (p. 53) Fig. 5.—Male imago. × 3. Fig. 6.—Callipers of female. × 6.

7. *Apterygida albipennis* Megerle. (p. 58) Male imago. × 3.

1

2

3

4

♂

5

♀

6

7

Plate 6

PLATE VI.

FIG.

1. Ootheca of *Ectobius** Stephens. (pp. 76, 82) × 5.
2. *Blattella germanica* Linnæus, ventral aspect when carrying ootheca. (p. 88) × 2.
3. Ootheca of *Periplaneta americana* Linnæus, with nymph emerging. (p. 102) × 2.
4. *P. americana* carrying ootheca, dorsal view. (p. 102) × 2.
5. *P. americana*, lateral view. × 2.
6. *P. americana*, ventral view. × 2.
7. *Forficula auricularia* Linnæus, in nest with eggs. (pp. 49, 50) Nat. size.
8. Nest of *F. auricularia*, containing eggs. Nat. size.

* Probably *E. panzeri*.

1

2

3

4

5

6

7

8

Plate 7

PLATE VII.

Fig.

1. *Ectobius lapponicus* Linnæus. (p. 74) Fig. 1.—Male imago. Nat. size. Fig. 1*a*.—Female imago. Nat. size. Fig. 1*b*.—Pronotum. × 4.
2. *E. panzeri* Stephens. (p. 82) Pronotum. × 4.
3. *E. perspicillaris* Herbst. (p. 79) Pronotum. × 4.
4. *Blattella germanica* Linnæus. (p. 87) Fig. 4.—Imago. × about ·67. Fig. 4*a*.—Nymph. × about ·67.
5. *Blatta orientalis* Linnæus. (p. 94) Fig. 5.—Male imago. × about ·67. Fig. 5*a*.—Female imago. × about ·67.
6. *Periplaneta americana* Linnæus. (p. 101) Fig. 6.—Male imago with wings spread. × about ·67. Fig. 6*a*.—Imago with wings closed. × about ·67.
7. *P. australasiæ* Fabricius. (p. 105) Fig. 7*b*.—Imago with wings spread. × about ·67. Fig. 7*a*.—Imago with wings closed. × about ·67.
8. *Leucophæa surinamensis* Linnæus. (p. 111) Fig. 8.—Imago with wings spread. × about ·67. Fig. 8*a*.—Imago with wings closed. × about ·67. Fig. 8*b*.—Nymph. × about ·67.

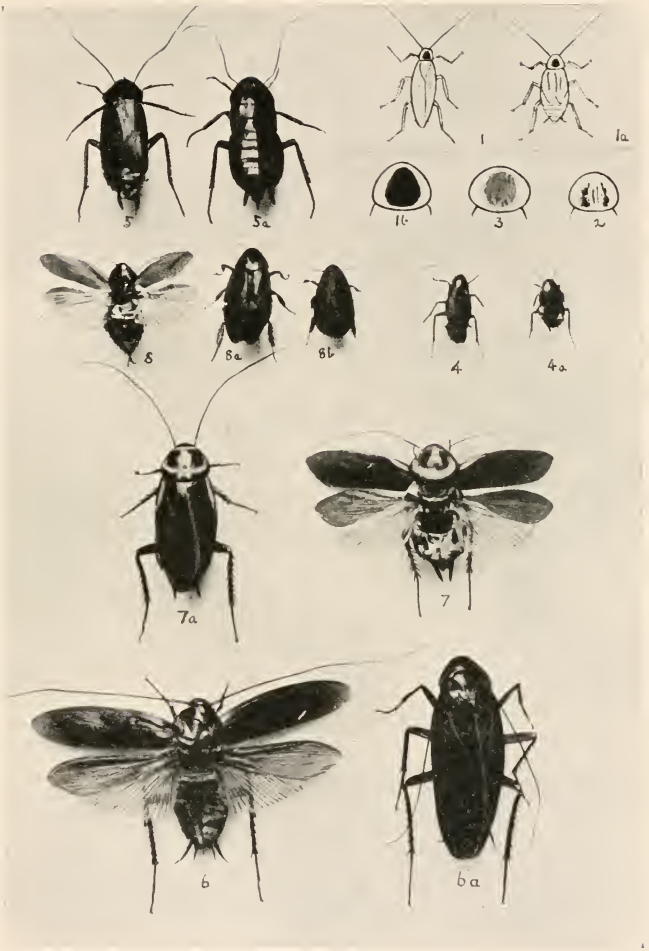

5
5a
1
1a
1b
3
2
8
8a
8b
4
4a
7a
7
6
6a

Plate 8

PLATE VIII.

Fig.

1. *Ectobius lapponicus* Linnæus. (p. 75) Male imago. New Forest, 4 June 1899. × 2.
2. *E. lapponicus* Linnæus. (p. 75) Female imago. New Forest, June 1914. × 2.
3. *E. perspicillaris* Herbst. (p. 79) Imago. Mickleham Downs, Surrey, 19 Aug. 1906. × 2.
4. *E. panzeri* Stephens. (p. 82) Male imago. New Forest, 20 Aug. 1917. × 2.
5. *E. panzeri* Stephens. (p. 82) Female imago. New Forest, 11 Aug. 1915. × 2.

1

2

3

4

5

Plate 9

PLATE IX.

Fig.

1. *Periplaneta americana* Linnæus. (p. 101) Male imago with wings spread. Nat. size.
2. *P. australasiæ* Fabricius. (p. 106) Male imago with wings spread. Kew Gardens, 23 Apr. 1895. Nat. size.

1

2

Plate 10

PLATE X.

FIGS.

1, 2. *Leucophæa surinamensis* Linnæus. (p. 112) Fig. 1.—Imago with wings spread. Fig. 2.—Nymph. Kew Gardens. × about 1·2.

3, 4. *Blatta orientalis* Linnæus. (p. 95) Fig. 3.—Female imago. Fig. 4.—Male imago. Kingston-on-Thames. Nat. size.

1

2

3 4

Plate 11

PLATE XI.

Fig.

1. *Periplaneta americana* Linnæus. (p. 101). Imago with wings closed. Zoological Gardens, London. × 1·5.
2. *P. australasiæ* Fabricius. (p. 106) Imago with wings closed. Kew Gardens. × 1·5.
3. *Leucophæa surinamensis* Linnæus. (p. 112) Imago with wings closed. Kew Gardens. × 1·5.

1

2

3

Plate 12

PLATE XII.

Figs.

1, 2. *Gryllotalpa gryllotalpa* Linnæus. (p. 122) Fig. 1.—Female imago with wings spread. Fig. 2.—Female imago with wings closed. New Forest. Nat. size.

3, 4. *Gryllus domesticus* Linnæus. (p. 140) Fig. 3.—Male imago. Fig. 4.—Female imago. Teddington, Middlesex. Nat. size.

1

2

3 4

Plate 13

PLATE XIII.

Figs.

1, 2. *Nemobius sylvestris* Fabricius. (p. 131) Fig. 1.—Male imago. Fig. 2.—Female imago. New Forest. × 3.

3. *Gryllus campestris* Linnæus. (p. 135) Male imago. Pett, Sussex. Nat. size.

1

2

3

Plate 14

PLATE XIV.

Fig.

1. *Phasgonura viridissima* Linnæus. (p. 178)
2. *Tettigonia verrucivora* Linnæus. (p. 173)
3. *Meconema thalassinum* De Geer. (p. 190)
4. *Pholidoptera griseoaptera* De Geer. (p. 153)
5. *Leptophyes punctatissima* Bosc. (p. 194)
6. *Conocephalus dorsalis* Latreille. (p. 185)
7. *Metrioptera brachyptera* Linnæus. (p. 163)
8. *M. albopunctata* Goeze. (p. 159)
9. *M. roeselii* Hagenbach. (p. 167)

Female imagines, for purposes of comparison, all × about ·67.

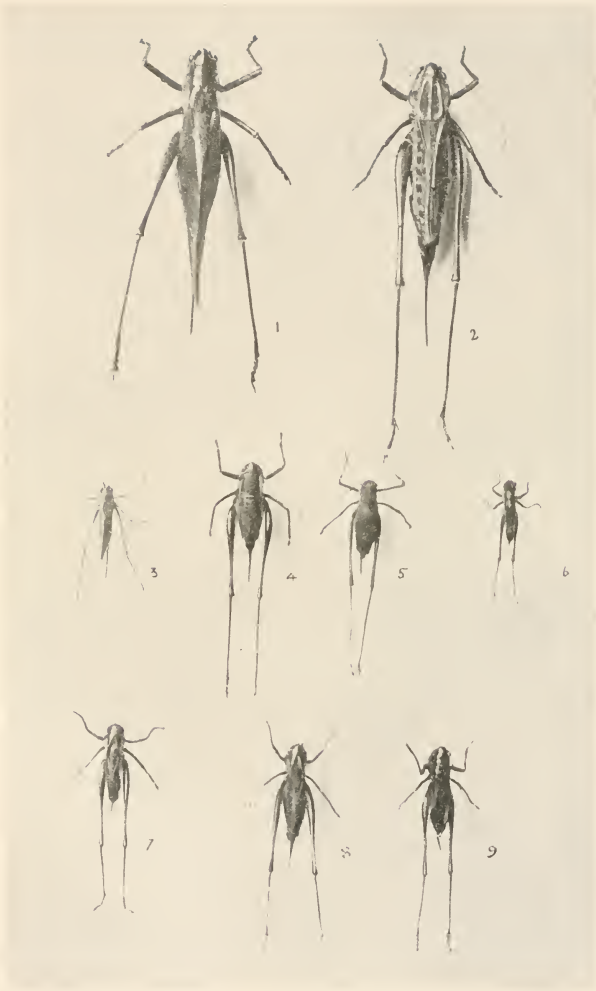

1
2
3
4
5
6
7
8
9

Plate 15

PLATE XV.

Figs.

1, 2. *Pholidoptera griseoaptera* De Geer. (p. 152) Fig. 1.—Male imago. Fig. 2.—Female imago. New Forest. Nat. size.

3, 4. *Conocephalus dorsalis* Latreille. (p. 185) Fig. 1.—Male imago. Fig. 2.—Female imago. Nat. size.

1

2

3

4

Plate 16

PLATE XVI.

Fig.

1. *Metrioptera roeselii* Hagenbach. (p. 166) Male imago.
2. *M. brachyptera* Linnæus. (p. 162) Male imago.
3. *M. albopunctata* Goeze. (p. 158) Male imago.

The three British species of the genus, all × 2.

1

2

3

Plate 17

PLATE XVII.

Figs.

1. *Tettigonia verrucivora* Linnæus. (p. 173) Male imago. Stonehall, near Dover, Oct. 1907. Nat. size.
2. *Phasgonura viridissima* Linnæus. (p. 178) Male imago. Torquay, 12 Aug. 1899. Nat. size.

3, 4. *Leptophyes punctatissima* Bosc. (p. 194) Fig. 3.—Male imago. New Forest, 4 Aug. 1900. Fig. 4.—Female imago. Near Guildford, Aug. 1897. × 1·5.

5. *Meconema thalassinum* De Geer. (p. 190) Female imago. New Forest, 4 Aug. 1900. × 1·5.

1

2

3

4

5

Plate 18

PLATE XVIII.

Figs.

1, 2. *Phasgonura viridissima* Linnæus. (p. 178) Fig. 1.—Female imago with wings spread. Nat. size. Fig. 2.—*In situ* on furze-bush and closely resembling its surroundings.

3. *Meconema thalassinum* De Geer. (p. 190) Female imago, on trunk of oak, in the position assumed while ovipositing. New Forest, Oct. 1911. Nat. size.

1

2

3

Plate 19

PLATE XIX.

British Gomphocerids and Stenobothrids for purposes of comparison. All × ·84.

Fig.

1. *Gomphocerus rufus* Linnæus. (p. 218) Male imago. Denbies, Surrey, 12 Sept. 1916.
2. *G. maculatus* Thunberg. (p. 221) Male imago. Boxhill, Surrey, 8 Sept. 1916.
3. *Stenobothrus lineatus* Panzer. (p. 233) Female imago. Denbies, 12 Sept. 1916.
4. *Stauroderus bicolor* Charpentier. (p. 244) Female imago.
5. *Omocestus rufipes* Zetterstedt. (p. 236) Female imago. New Forest, 21 Aug. 1912.
6. *O. viridulus* Linnæus. (p. 239) Female imago. New Forest, 8 Aug. 1905.
7. *Chorthippus elegans* Charpentier. (p. 249) Male imago. New Forest, 27 Aug. 1903.
8. *C. parallelus* Zetterstedt. (p. 252) Male imago. New Forest, 21 Aug. 1905.

1
2
3
4
5
6
7
8

Plate 20

PLATE XX.

Elytra of the males of the British Acridians (except *Tetrix*); costal margin upward except fig. 4. × 2·25.

Fig.

1. *Stenobothrus lineatus* Panzer. (p. 232)
2. *Gomphocerus rufus* Linnæus. (p. 218)
3. *G. maculatus* Thunberg. (p. 221)
4. *Mecostethus grossus* Linnæus. (p. 227)
5. *Omocestus rufipes* Zetterstedt. (p. 236)
6. *O. viridulus* Linnæus. (p. 238)
7. *Stauroderus bicolor* Charpentier. (p. 243)
8. *Chorthippus elegans* Charpentier. (p. 249)
9. *C. parallelus* Zetterstedt. (p. 252)

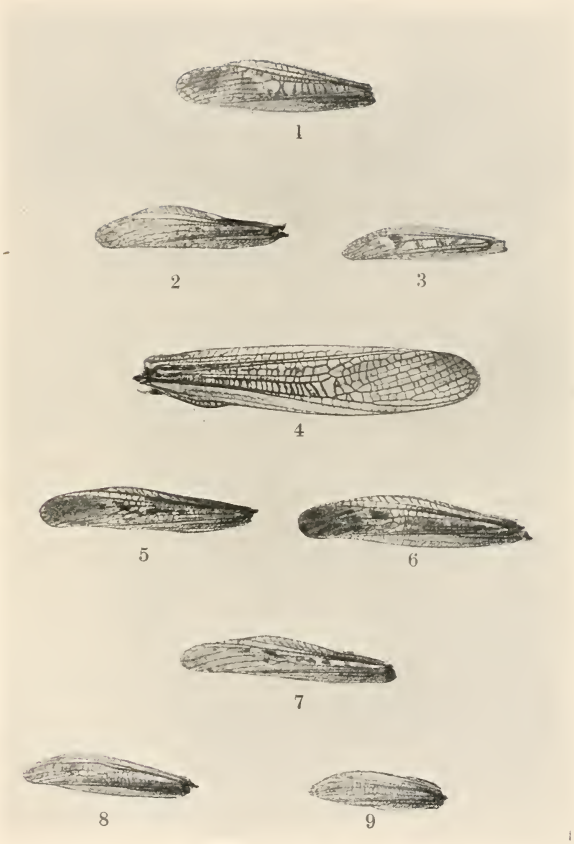

1
2
3
4
5
6
7
8
9

Plate 21

PLATE XXI.

Figs.

1, 1*a*. *Tetrix bipunctatus* Linnæus. (p. 212) Fig. 1.—Dorsal view. Fig. 1*a*.—Lateral view of female. × 4.

2, 2*a*. *T. subulatus* Linnæus. (p. 207) Fig. 2.—Dorsal view. Fig. 2*a*.—Lateral view. × 4.

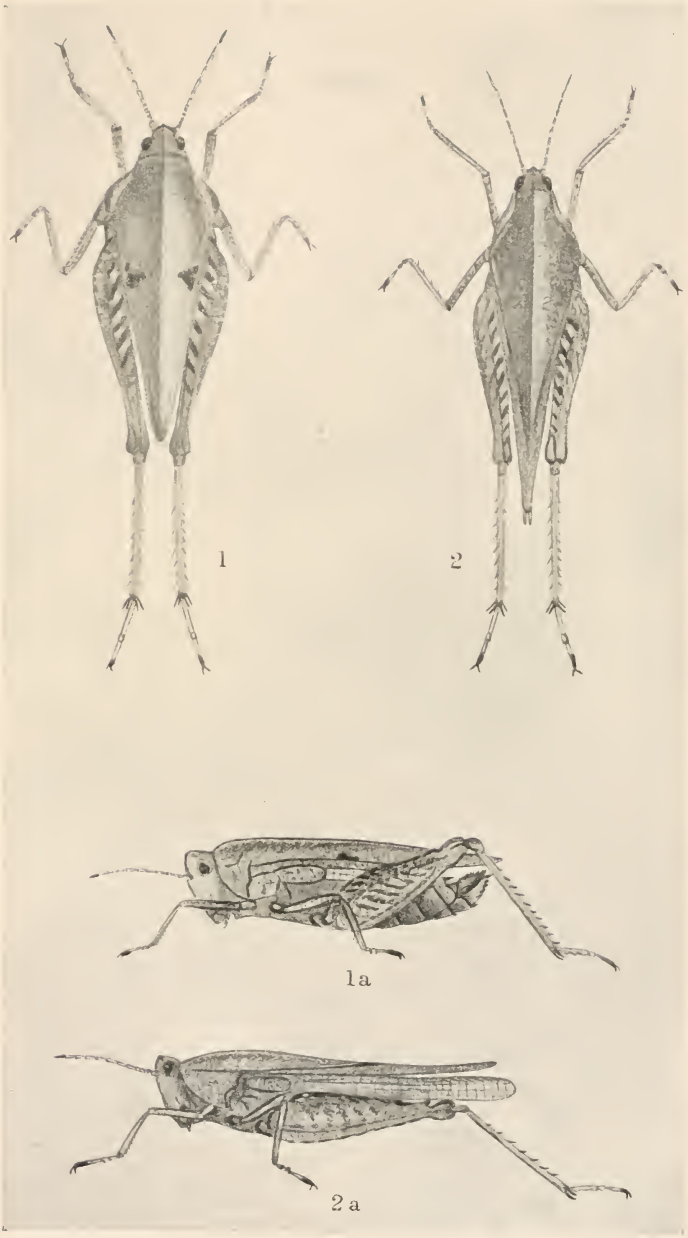

1
2
1a
2a

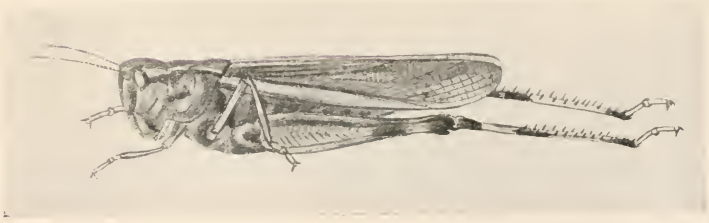
Plate 22

PLATE XXII.

Figs.

1, 2. *Mecostethus grossus* Linnæus. (p. 226) Fig. 1.—Female imago with wings spread. Fig. 2.—Female imago with wings closed. New Forest. × 1·5.

1



2

Plate 23

PLATE XXIII.

Figs.

1. *Tetrix subulatus* Linnæus. (p. 207) Male imago of uniform ruddy tint. Widemouth, Bude, Aug. 1911. × 3.

2, 3. *Gomphocerus maculatus* Thunberg. (p. 221) Fig. 2.—Antenna of male. New Forest, 5 Aug. 1893. Fig. 3.—Antenna of female. Christchurch, Hants, 9 Aug. 1897. × 20.

4, 5. *G. rufus* Linnæus. (p. 218) Fig. 4.—Antenna of female. Bookham Common, Surrey, 11 Sept. 1904. Fig. 5.—Antenna of male. Bookham Common, 3 Sept. 1895. × 20.

6. *Omocestus rufipes* Zetterstedt. (p. 234) Face of imago, to illustrate the white palpi. New Forest, 1914. × 6.

7. *Chorthippus parallelus* Zetterstedt. (p. 251) Male imago. Near Weymouth, Aug. 1902. × 2.

8. *Stenobothrus lineatus* Panzer. (p. 232) Male imago. Dorking, Surrey, Sept. 1916. × 2.

9. *Chorthippus elegans* Charpentier. (p. 248) Male imago. Holmsley, New Forest, 2 Sept. 1918. × 2.

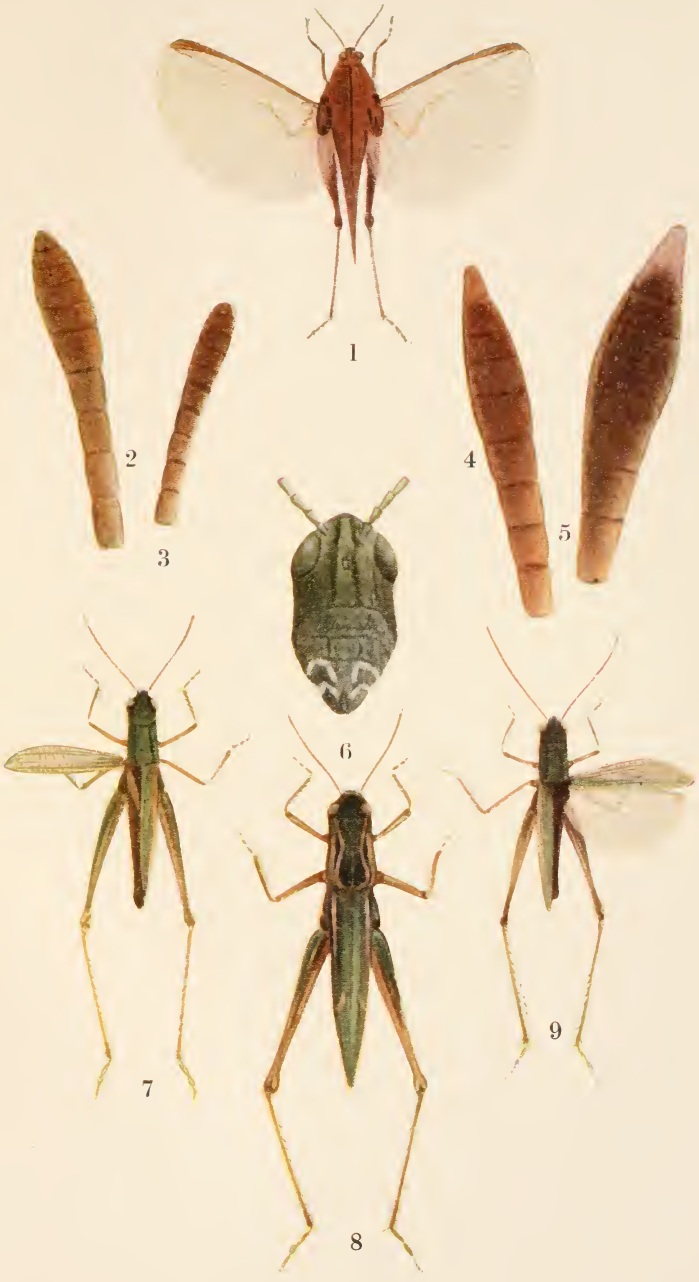

1
2
3
4
5
6
7
8
9

Plate 24

PLATE XXIV.

FIGS.

1, 2. *Omocestus viridulus* Linnæus. (p. 238) Fig. 1.—Male imago with wings spread. × about 3. Fig. 2.—Female imago with wings closed. × 2.

1

2

Plate 25

PLATE XXV.

FIGS.

1, 2. *Stauroderus bicolor* Charpentier. (p. 242) Fig. 1.—Female imago with wings spread. Weymouth, Aug. 1902. × about 2. Fig. 2.—Male imago with wings closed; speckled form. Swanage, 17 Aug. 1908. × 2.

1

2

THE

RAY SOCIETY.

LIST OF

RECENT AND FORTHCOMING

PUBLICATIONS.

JANUARY, 1920.

OFFICERS AND COUNCIL.

1919–20.

President.

Prof. W. C. McINTOSH, M.D., LL.D., F.R.S., F.R.S.E., F.L.S., etc.

Vice-Presidents.

CHARLES OLDHAM, F.L.S., F.Z.S., M.B.O.U.

Prof. E. B. POULTON, M.A., D.Sc., LL.D., F.R.S., F.L.S., F.Z.S.

Sir DAVID PRAIN, C.M.G., C.I.E., M.A., LL.D., F.R.S., F.L.S.

Council.

Robert Adkin, F.E.S.

Lt.-Col. A. W. Alcock, C.I.E., M.B., LL.D., F.R.S.

E. A. Bowles, M.A., F.L.S., F.E.S.

Rev. C. R. N. Burrows, F.E.S.

T. A. Chapman, M.D., F.R.S., F.Z.S., F.E.S.

Rev. Alfred Fuller, M.A., F.E.S.

T. H. Hiscott, F.R.M.S.

B. Daydon Jackson, Ph.D., F.L.S.

G. B. Longstaff, M.D., F.L.S.

A. W. Oke, F.L.S.,

R. S. W. Sears, F.R.M.S.

A. W. Sheppard, F.L.S., F.R.M.S.

C. D. Soar, F.L.S., F.R.M.S.

W. Mark Webb, F.L.S., F.R.M.S.

Joseph Wilson, F.R.M.S.

Treasurer.

SIDNEY F. HARMER, M.A., Sc.D., F.R.S., F.L.S., F.Z.S.

Secretary.

W. T. CALMAN, D.Sc., F.L.S., F.Z.S.;
1, Mount Park Crescent, Ealing, W. 5.

RECENTLY ISSUED AND FORTHCOMING MONOGRAPHS.

For the Sixty-first Year, 1904.

82. The British Desmidiaceæ. By W. and G. S. West. Vol. I. xxxvi + 224 + 64 pp., 32 plates. 8vo. 1904.

83. The British Tunicata. By the late Joshua Alder and the late Albany Hancock. Edited by John Hopkinson. Vol. I. With a History of the Work by Canon A. M. Norman. xvi + 146 + 42 pp., 20 plates, and frontispiece. 8vo. 1905.

For the Sixty-second Year, 1905.

84. The British Desmidiaceæ. By W. and G. S. West. Vol. II. x + 206 + 64 pp., 32 plates (xxxiii–lxiv). 8vo. 1905.

85. The British Freshwater Rhizopoda and Heliozoa. By James Cash, assisted by John Hopkinson. Vol. I. The Rhizopoda, Part I. x + 150 + 32 pp., 16 plates. 8vo. 1905.

For the Sixty-third Year, 1906.

86. The British Tunicata. By the late Joshua Alder and the late Albany Hancock. Edited by John Hopkinson. Vol. II. With Lives of the Authors by Canon Norman and Dennis Embleton. xxviii + 164 + 62 pp., 30 plates (xxi–l), and frontispiece. 8vo. 1907.

For the Sixty-fourth Year, 1907.

87. The British Marine Annelids. By W. C. McIntosh. Vol. II, Part I. Polychæta. Nephthydidæ to Syllidæ. viii + 232 + 46 pp., 22 plates (xliii–l, lvii–lxx). Folio. 1908.

For the Sixty-fifth Year, 1908.

88. The British Desmidiaceæ. By W. and G. S. West. Vol. III. xvi + 274 + 62 pp., 31 plates (lxv–xcv). 8vo. 1908.

89. The British Freshwater Rhizopoda and Heliozoa. By the late James Cash, assisted by John Hopkinson. Vol. II. The Rhizopoda, Part II. xviii + 168 + 32 pp., 16 plates (xvii–xxxii), and frontispiece. 8vo. 1909.

For the Sixty-sixth Year, 1909.

90. The British Nudibranchiate Mollusca. By the late Joshua Alder and the late Albany Hancock. Part 8 (supplementary). Text by Sir Charles Eliot. viii + 198 + 18 pp., 8 plates. Folio. 1910.

For the Sixty-seventh Year, 1910.

91. The British Marine Annelids. By W. C. McIntosh. Vol. II, Part 2. Polychæta. Syllidæ to Ariciidæ. vii + 292 (233–524) + 46 pp., 23 plates (li–lvi, lxxi–lxxxvii). Folio. 1910.

For the Sixty-eighth Year, 1911.

92. The British Desmidiaceæ. By W. and G. S. West. Vol. IV. xiv + 194 + 66 pp., 33 plates (xcvi–cxxviii). 8vo. 1912.

93. The British Tunicata. By the late Joshua Alder and the late Albany Hancock. Edited by John Hopkinson. Vol. III. xii + 114 + 34 pp., 16 plates (li–lxvi), and frontispiece. 8vo. 1912.

For the Sixty-ninth Year, 1912.

94. A Bibliography of the Tunicata. By John Hopkinson. xii + 288 pp. 8vo. 1913.

95. The British Parasitic Copepoda. By Thomas and Andrew Scott. Vol. I (Copepoda parasitic on Fishes, Part I).—Text. xii + 256 pp., 2 plates. 8vo. 1913.

For the Seventieth Year, 1913.

96. The British Parasitic Copepoda. By Thomas and Andrew Scott. Vol. II (Copepoda parasitic on Fishes, Part II).—Plates. xii + 144 pp., 72 plates. 8vo. 1913.

For the Seventy-first Year, 1914.

97. The British Marine Annelids. By W. C. McIntosh. Vol. III. Part I.—Text. Polychæta. Opheliidæ to Ammocharidæ. viii + 368 pp. Folio. 1915.

For the Seventy-second Year, 1915.

98. The British Freshwater Rhizopoda and Heliozoa. By James Cash and G. H. Wailes, assisted by John Hopkinson. Vol. III. The Rhizopoda, Part III. By G. H. Wailes. xxiv + 156 + 52 pp., 25 plates (xxxiii–lvii), and frontispiece. 8vo. 1915.

For the Seventy-second Year, 1915 (*contd.*).

99. The Principles of Plant-Teratology. By W. C. Worsdell. Vol. I. xxix + 270 + 50 pp., 25 plates. 8vo. 1915.

For the Seventy-third Year, 1916.

100. The British Marine Annelids. By W. C. McIntosh. Vol. III. Part II.—Plates. viii + 48 pp., 24 plates. Folio. 1915.

101. The Principles of Plant-Teratology. By W. C. Worsdell. Vol. II. xvi + 296 + 56 pp., 28 plates (xxvi–liii). 8vo. 1916.

For the Seventy-fourth Year, 1917.

102. The British Charophyta. By James Groves and Canon George Russell Bullock-Webster. Vol. I. Nitelleæ, with Introduction. xiv + 142 + 40 pp., 20 plates. 1920.

For the Seventy-fifth Year, 1918.

103. The British Freshwater Rhizopoda and Heliozoa. By James Cash and G. H. Wailes, assisted by John Hopkinson. Vol. IV. Supplement to the Rhizopoda by G. H. Wailes and Bibliography by John Hopkinson. xii + 130 + 12 pp., 6 plates (lviii–lxiii). 8vo. 1919.

For the Seventy-sixth Year, 1919.

104. A Monograph of the British Orthoptera. By W. J. Lucas. xii + 264 + 52 pp., 26 plates. 1920.

In Course of Publication.

The British Freshwater Rhizopoda and Heliozoa. By the late James Cash and G. H. Wailes. (Vol. V, Heliozoa, will complete the work.)

The British Charophyta. By James Groves and Canon Bullock-Webster. (Vol. II will complete the work.)

The British Marine Annelids. By Prof. W. C. McIntosh.

The British Desmidiaceæ. By the late W. and G. S. West.